ARCHIVES OF OPHTHALMOLOGY.

OBSERVATIONS ON THE MACULA LUTEA.

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(*With 10 microphotographs in the text.*)

HISTOLOGY OF THE HUMAN MACULA.[1]

In a former article on this subject (vol. xxi., pp. 1–21), I dealt with the ophthalmoscopic appearances of the healthy macula. I therein drew attention to the shape of the macula reflex, and to the internal reflex of the fovea, and expressed the belief that these reflexes, as well as those observable along the retinal vessels, were probably due to the inequalities of the surface of the tissues, which, if decreasing with age, would account for the gradual disappearance of these reflexes.

I thought that the only satisfactory way of testing this would be by microscopical examination of perfectly healthy retinæ of individuals of various ages.

At the very outset I was struck by the considerable differences which the retina presented in some of the most important points as compared with the descriptions generally given; and as I advanced it became more and more evident that, in order to understand the histology of the macula, I should have to re-examine the minute anatomy of the entire retina. I need hardly point out how difficult it is to obtain the necessary material for such research, as the retina is so highly differentiated, and therefore degenerates so rapidly, that the tissues of eyes require not only to be abso-

[1] My friend Mr. Henry de Mosenthal has rendered me invaluable assistance in preparing this series of papers. He has examined my entire series of microscopic specimens, and I have had the advantage of discussing every point with him.

lutely healthy, but they must be fixed with extreme rapidity. I should certainly not have succeeded but for the great assistance I received from Mr. Lawson, Mr. Power, Mr. Higgins, Mr. MacKinlay, Mr. Brailey, and Dr. Landolt, of Paris, whereby I was enabled to obtain a number of healthy eyes.

The methods of fixing, preserving, and preparing eyes as best suited for this particular work would, if here detailed, overburden this article. I therefore propose to discuss these methods on a future occasion, but wish to take this opportunity of thanking Mr. Bolles Lee and Dr. E. C. Bousfield for their kind advice and assistance.

I have made serial sections of eyes of individuals of different ages, ranging from the five-months fœtus to old age, and I propose in this and the subsequent papers to record my results, discussing the histology of the various layers of the retina in their order from without.

I have tried to illustrate my results by microphotographs, and hope that the accompanying process reproductions of them will be found more satisfactory than the ordinary drawings, which invariably leave much to be desired on the side of accuracy. Microphotographs, on the other hand, show such superabundance of detail that the salient points are less striking; and, as it is only possible to photograph in one plane, all parts cannot be in focus—defects which, to my mind, are more than compensated for by the elimination of the personal factor.

A.—THE HEXAGONAL PIGMENT LAYER.

From the study of the development of the eye, the hexagonal pigment layer is universally conceded to belong to the retina, but it is held to be histologically united to the membrana vitrea.

I find that the membrana vitrea is exclusively choroidal, and forms so intimate a part of the choroid that it cannot be detached from it without tearing and without the destruction of the vascular walls of the chorio-capillaris. I further find that between the membrana vitrea and the hexagonal pigment layer there is a space, the outer boundary of which is the membrana vitrea, and the inner also a distinct membrane, which I propose calling the "MEMBRANA TERMINANS RETINÆ."

The membrana terminans is connected with the membrana vitrea by very minute fibrillæ, similar to the retiform fibrillæ which we find connecting the surfaces of minute lymphatic spaces in many other parts of the body. Often I find the membrana terminans so near the membrana vitrea that the space between the two is not perceptible; then again I find the space between the two membranes very noticeable, the fibrillæ being stretched from the one membrane to the other almost at right angles, and between these two extremes every intermediate stage seems to exist. The following illustration shows the space between the membrana vitrea and the membrana terminans and the fibrillæ holding the two membranes together.

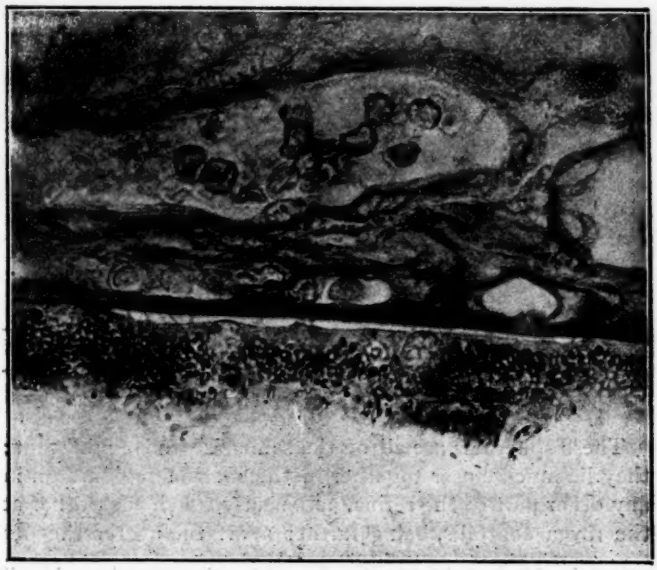


FIG. 1.[1]

Vertical section through the choroid and hexagonal pigment layer showing the space between the M. vitrea and M. terminans and the fibrillæ connecting them. Ehrlich-Biondi and nigrosin stain. x 1060 diams. (Zeiss 2 *mm* apo. obj.; 2 proj. ocular; camera extension 98 *cm.*)

[1] All the microphotographs have been taken on half plates (6½" x 4¾") and then cut down to allow of printing with the text.

N.B.—*All the illustrations of vertical sections are placed relatively in the same position viz., with the external portion upwards.*

In many of my specimens I find the hexagonal pigment layer detached from the choroid, and in those cases I can, as a general rule, see the torn ends of the fibrillæ adhering partly to the membrana vitrea, and partly to the membrana terminans.

As to the hexagonal pigment layer itself, it is permeated to such an extent with pigment that it is excessively difficult to distinguish its structure clearly unless very thin sections be made.

It seems to me that what have until now been taken for the nuclei of hexagonal cells are independent spherical corpuscles (spherules), as shown in the following figure.

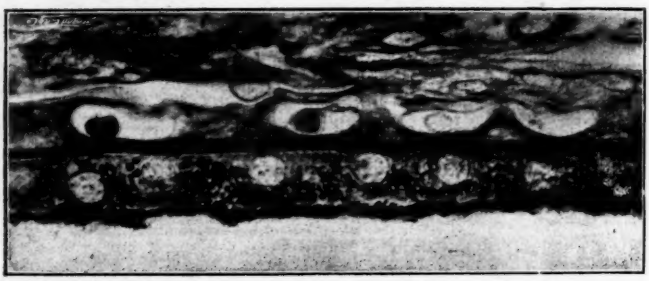


FIG. 2.

Vertical section through the choroid and the hexagonal pigment layer showing round spherules resting against the membrana terminans. Ehrlich Biondi and nigrosin stain. x 1180 diam.[1] (Zeiss 3 *mm* apo. obj. No. 4 proj. ocular; camera extension 90 *cm*.)

These spherules are all of the same size and equidistant; they lie much closer together in the macula region than in any other part of the retina, and nearly touch each other at the fovea centralis, being farther apart the nearer the ora serrata. This seems to indicate that the spherules play an important part in vision.

In eyes which have been subject to pressure, as is the case in glaucoma and certain ocular tumors, I find the spher-

[1] In order to ensure accuracy the magnification of the illustrations have in every case been determined with the micrometer scale placed on the stage and focussed on to the photographic screen.

ules appearing horizontally oval, in section, just as a rubber ball would appear if compressed by a weight; and this seems to point to the spherules being elastic. Artificial pressure during the preparation of the specimen will also sometimes produce the same effect.

The following photograph which illustrates the above is taken from a section of an eye removed for persistent glaucoma with high tension.

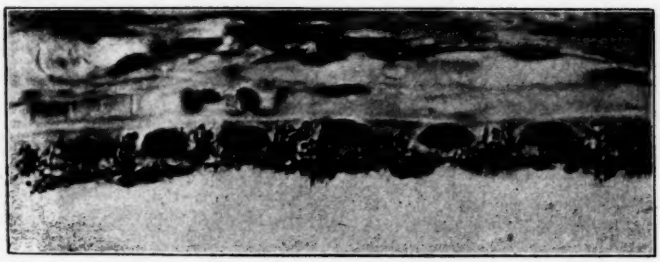


FIG. 3.

Vertical section through choroid and hexagonal pigment layer, showing oval spherules. Hæmatox. stain. x 1180 diam. (Zeiss 3 *mm* apo. obj.; No. 4 proj. ocular; camera extension 90 *cm.*)

In some specimens I have noticed the spherules entirely detached, and frequently distinct spaces are observable around the spherules, which I ascribe to shrinkage during the dehydration of the specimen.

I need hardly say that I have had considerable hesitation before calling into doubt the existence of nucleated hexagonal cells in this layer. I examined the eye of an albino rabbit, the section of which showed the spherules quite clearly, and I have seen the same appearance in sections of the eyes of various animals.

The fact that in some cases these spherules are entirely detached and float free in the field of the microscope, the fact that I have never seen hexagonal cells isolated or even partially detached from each other along the line of the septa, and lastly the fact that spaces can frequently be seen around these spherules when in situ, all point to their not

being nuclei. Moreover, the regularity of the spherules and their general appearance afford me further grounds for believing that the hexagonal pigment layer has a different structure to that usually accepted.

I would describe it as formed of two entirely different superposed layers.

1. THE OUTER LAYER—THE GELATINOUS LAYER,—which is the true hexagonal pigment layer, consists of a gelatinous homogeneous stratum, which stains uniformly throughout, limited externally by the membrana terminans retinæ and having internally a well defined boundary parallel to it. In this gelatinous layer spherules lie embedded at equal distances. Around each spherule, spherical pigment granules are embedded in the gelatinous matrix, like currants in a jelly. These granules become more numerous the further they are from the spherules, and form distinct lines of polygonal shape, being separated from the granules which surround the spherule in the next area by a clear line of the gelatinous matrix. The granules which are embedded on each side of this clear portion are arranged in a straight line. Viewed vertically no separations are visible, and the pigment granules cease wholly in the vicinity of the membrana terminans so as to leave a clear portion at the outer edge of the layer.

If the usual description of hexagonal cells held together by cement were correct, septa ought to be perceptible in vertical sections. This, however, is not the case. Pigmented streaks are perceptible where the pigment granules lie closest, and these streaks become more marked when the gelatinous layer has been subjected to pressure.

Transverse sections, when stained with Biondi-nigrosin, show the gelatinous layer as a homogeneous pale blue matrix containing the spherules and permeated with pigment granules. As the granules are absent in the immediate vicinity of the membrana terminans, transverse sections, when very slightly oblique, show at the edge the clear hyaline layer containing spherules but free from pigment granules. In these clear portions no trace of septa can be seen, as shown in the following photograph.

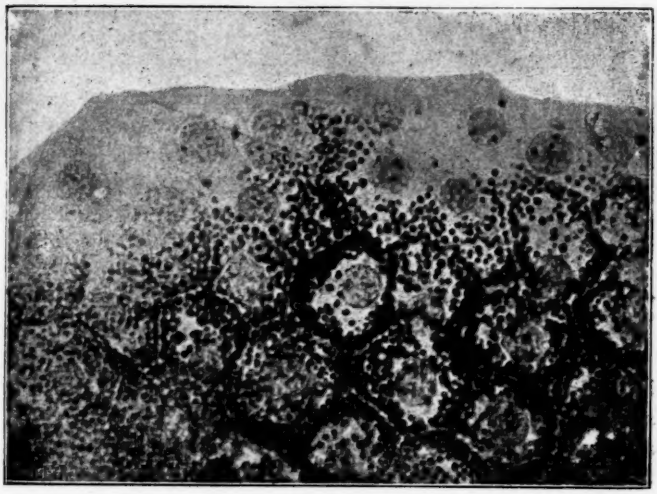


FIG. 4.

Transverse section (slightly oblique) through the hexagonal layer showing hexagons and at the border the clear hyaline layer interspersed with spherules. x 1080 diam. (Zeiss 2 *mm* apo. obj.; No. 2 proj. ocular; camera extension 100 *cm*.)

It seems to me hardly likely, if the septa exist, that the cement and cells would stain so uniformly as to be indistinguishable; I have not been able to differentiate them with any of the known stains or lakes. What have been taken for distinct septa therefore seem to be nothing more than clear portions of the gelatinous stroma lying between two parallel lines of pigment granules.

2. THE INNER LAYER—THE PIGMENT CRYSTAL LAYER, —consists of ill-defined irregularly strewn clusters of acicular or oat-shaped pigment crystals, entirely distinct in shape and appearance from the pigment granules which are embedded in the gelatinous layer.

The following figure shows the granules and the crystals. The boundary line of demarcation between these two distinct forms of pigment shows less clearly in this very highly magnified illustration than in Fig. 2.

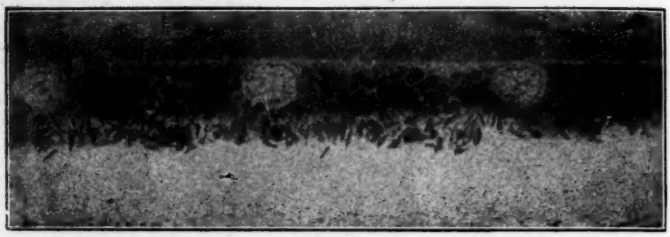


FIG. 5.

Vertical sections through the hexagonal pigment layer showing the two forms of pigment. x 1560 diam. (Zeiss 2 *mm* apo. obj. ; No. 2 proj. ocular ; camera extension 145 *cm.*)

Whilst the round pigment granules are firmly embedded in their gelatinous matrix, the acicular pigment crystals seem free to move. They lie in clusters in and adhere to a network—which I propose to term THE PIGMENT CRYSTAL PLEXUS—consisting of excessively fine fibre-threads lying like a thin gauze, two, three, and sometimes four meshes deep, on the gelatinous layer to which it is organically united.

In undisturbed specimens of vertical sections the plexus is usually invisible, being entirely obscured by the dense clusters of crystals. In order to show this plexus I have therefore had to select a specimen in which the pigment crystal layer has been disturbed and the plexus become partly uncovered. The following figure represents such a specimen :

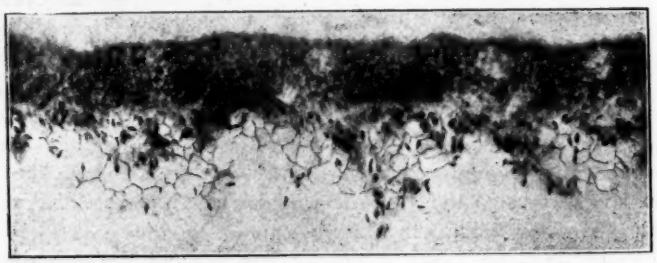


FIG. 6.

Vertical section of hexagonal pigment layer with disturbed pigment crystal layer showing the pigment crystal plexus. Hæmatoxylin stain. x 1000 diam. (Zeiss 3 *mm* apo. obj. ; No. 2 proj. ocular ; camera extension 134 *cm.*)

The acicular crystals are so highly refractive as to make it very difficult to define their borders, but they always appear elongated. I have never found them outside this plexus, nor in the gelatinous layer, except in specimens which have been subjected to pressure or disturbed in manipulation.

I have not been able to trace exactly how the crystal pigment plexus is connected with the gelatinous layer and the spherules. That, however, they are organically united seems to be clearly demonstrated by the fact that, in specimens which show the retina detached from the choroid by a rupture of the fibrillæ between the membrana vitrea and the membrana terminans, the whole hexagonal pigment layer is drawn away by the bacillary layer of which the crystal pigment plexus forms a part.

Transverse sections through the crystal pigment plexus show that the meshes are of the same shape and size as the hexagons of the gelatinous layer.

To illustrate this Figs. 7 and 8, of equal magnification, are here given.

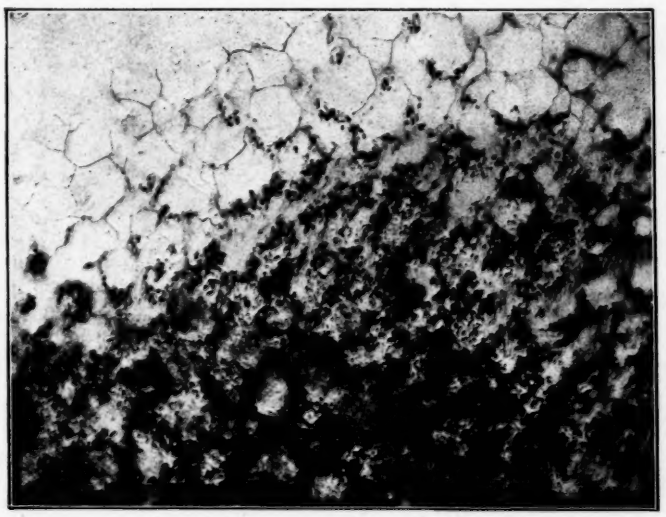


FIG. 7.

Transverse section through the crystal pigment plexus. x 560 diam. (Zeiss 3 *mm* apo. obj.; No. 2 proj. ocular; camera extension 83 *cm*.)

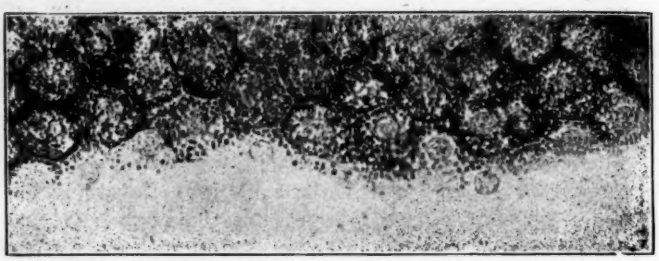


FIG. 8.

Transverse section through the gelatinous layer. x 560 diam. (obj., etc., as in Fig. 7).

A comparison of the two last figures leads to the assumption that the crystal pigment plexus penetrates the gelatinous layer along the clear spaces left between the pigment granules as far as the hexagons extend. It seems likely that there this plexus is connected with the spherules by fine fibrillæ, as in specimens in which the gelatinous layer has been disturbed I have been able to trace fine fibrillæ adhering to the spherules. The following figure shows such a specimen.

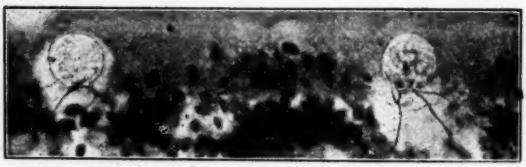


FIG. 9.

Vertical section through the disturbed gelatinous layer showing spherules with fibrillæ attached. x 1620 diam. (Zeiss 2 *mm* apo. obj.; No. 2 proj. ocular; camera extension 142 *cm.*)

We shall, when discussing the bacillary layer, find that the crystal pigment plexus is inseparably bound to it, so that the retinal nerve fibrils most probably terminate inside these spherules.

Owing to the minuteness of the spherules and the difficulty of obtaining differential staining it is not easy to

analyze their internal structure. It seems, however, as if the nerve fibril or fibrils terminate in a bulbous end in the centre of the spherule, there kept in position by a number of fine radiating fibres embedded in a granular substance which fills the spherule. Indications of this will be found in Figs. 2, 5, and 9, but I have specially photographed a spherule with very high magnification. I thought it well, in this instance, to add to the photograph of a human spherule that of a spherule from the eye of a monkey.

A. B.

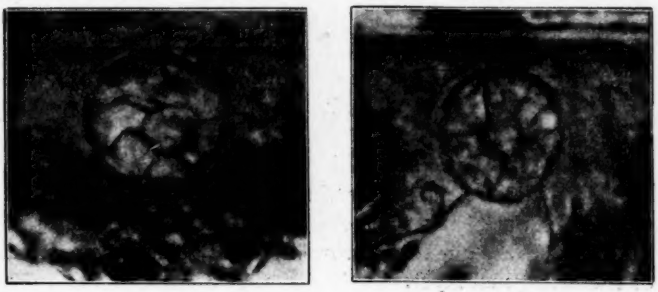


FIG. 10.

Vertical section of spherules. x 3000 diam. (Zeiss 2 *mm* apochr. obj.; No. 4 proj. ocular; camera extension 142 *cm.*)

(A) From a man.
(B) From a monkey *(Cercocebus Fuliginosus).*

To recapitulate, then—the membrana vitrea is the limit of the choroid—then follows a space—then the membrana terminans retinæ—then a gelatinous layer in which spherules lie surrounded by embedded spherical pigment granules—lastly, the acicular pigment crystals lying in irregular clusters in a plexus.

This plexus is a direct continuation of the bacillary layer, and enters the gelatinous layer to terminate at the spherules, which latter seem to be closely connected with, and may essentially be found to contain, the ultimate terminals of the optic nerve fibres. At the macula the spherules lie much closer together than in any other part of the retina and nearly touch each other at the fovea centralis.

Without, at this stage, entering into the discussion of any of the physiological and other questions which the above description raises, I may briefly state that I am led to account for the most frequent form of detached retina as being due to the tearing of the bacillary layer, whilst the less serious and rarer form is due to the tearing of the fibrillæ which hold the hexagonal layer to the choroid.

The tearing of the bacillary layer is of course a much graver accident as regards vision than when the hexagonal layer remains in uninterrupted continuity with the rest of the retina. In this latter case the detached retina is still capable of some vision, since the retinal arteries supply to some extent the functions of the choroidal vessels.

I have verified this by numerous examinations of eyes with detached retinæ, which had to be removed for various causes.

In the light of the above description of this layer, it also seems probable that the hyaline excrescences (Glassdrüsen frequently noticed in pathological and even in otherwise healthy eyes are due to outgrowths of the gelatinous portion of the hexagonal layer.

(To be continued.)

CONGENITAL NIGHT-BLINDNESS AND PIGMENTARY DEGENERATION.

By Dr. COLMAN W. CUTLER.

(From the Clinic of Prof. Fuchs.)

(*With 2 lithographic plates, I. and II. of Vol. XXX., German Edition.*)

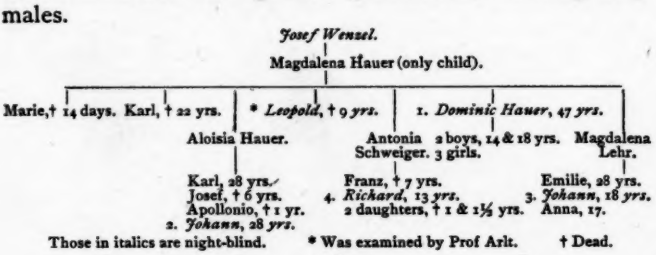
THE following cases of congenital night-blindness have been observed in the clinic of Prof. Fuchs in Vienna, and are reported at his suggestion.

The writer desires to express his gratitude for the opportunity offered him to use the material of the clinic, and for the assistance and advice so kindly given.

The first four cases have been known in the clinic for years, one member of the family having been examined by Prof. Arlt, but no records remain, except in one case, of previous examinations with which the present ones might be compared.

The mother of one of the patients, Case 2, is a nurse in the clinic; so it has been possible to get a complete history. and to examine three of the four repeatedly. Dominic Hauer, Case 1, the only one who does not live in Vienna, could only be examined once, but fortunately the record of the ophthalmoscopic examination, made by Prof. Fuchs three years ago, was at hand for comparison.

The following genealogical tree shows the transmission of the condition through five generations, affecting only males.



Those in italics are night-blind. * Was examined by Prof Arlt. † Dead.

Josef Wenzel, beyond whom the family traditions do not reach, was a mason by trade, living in Southern Austria. He was considered an unusually strong and healthy man, and died at about the age of eighty.

He suffered with night-blindness during his entire life, and it is believed that no change or progress took place in the condition. With a good light, vision was excellent. "He always went to bed at an uncommonly early hour, because his sight became poor at dusk."

Nothing is known of his ancestors, and consanguinity is denied.

To avoid repetition, it may be stated that no intermarriages have occurred in the family; no traces of syphilis are discoverable; there is no deafness; and no other diseases or anomalies of an hereditary nature have been found.

In the second generation there was only one child, Magdalena Hauer, whose husband is said to have been healthy.

In the third generation there were seven children; three males, two being night-blind.

CASE 1.—Dominic Hauer, aged forty-six; mason; has been night-blind during entire life. The condition has remained stationary. The left eye has always been weaker than the right, and as long as the patient can remember has had its present position. General health has always been excellent. Patient is a well built man, of good intelligence. General examination negative. Color of hair, light brown; of iris, gray. Teeth show no signs of syphilis or rachitis. The left eye is deflected slightly upwards and outwards, the pupil being slightly covered by the upper lid; this is caused by the raising of the bulbus and not by ptosis. The eyes externally, otherwise normal. Pupils equal, of normal size, and react well. The ophthalmoscope shows the media to be clear. The right fundus somewhat tessellated, the retinal pigment being uniformly rather scanty, but not to a pathological degree. Vessels a little narrow, but not abnormally so. The upper temporal arteries are of good size; the lower relatively small. Professor Fuchs, who had the kindness to examine the patient, considers the difference in the size of the vessels so slight that it would not have been noticed had we not been especially on the watch for abnormalities. Temporal half of papilla slightly

pale, shallow physiological excavation. Small conus outwards. No signs of pigment, and no white points or patches to be found in the fundus. Left eye the same, but with more uniformity of the vessels. The patient was examined three years ago by Professor Fuchs and it was seen that no change had taken place since that time, the same conditions of the vessels being noted at each examination.

Vision.—Right eye, $\frac{6}{12}$. Sn. 0.6 read at 12–38 *cm.* No astigmatism. Not improved by glasses. Left eye, $\frac{4}{60}$. Snellen not read. The light-sense was tested by Forster's photometer. An opening having a diagonal of 14 *mm* was required for the perception of light, and one or two more before the lines could be counted; $L = \frac{1}{49}$. [The normal eye requires an opening (h) of 2 *mm* diagonal; the opening required by the hemeralopic eye being H, light-sense, L, $= (\frac{h}{H})^2$.] The degree of night-blindness was the same after fifteen minutes and after one hour's adaptation. Color-sense, tested by the wools and by Stilling's test, normal.

The field of vision, examined by the perimeter, showed the outer limit, for white, of normal extent. The striking variation from the normal which the perimetric test with colors exhibited, will be discussed later to avoid repetition. Aloisia Hauer, the nurse in the clinic above mentioned, also belonging to the third generation, the mother of two of the patients examined, was found to have no hemeralopia. Normal fundus and field of vision. Of the fourth generation four were examined, three of them being night-blind.

Case 2.—Johann Hauer, aged twenty-one, apprentice in book store. Among the usual symptoms of night-blindness he says that he has only seen the largest stars. There has been no change whatever in the condition, which was noticed, according to his mother, in infancy. He has always been near-sighted, but reads easily with a good light. The patient is of more than average intelligence. General health has been good. General examination shows nothing abnormal except slight enlargement of cervical glands. The teeth are bad, but not characteristic of rachitis or syphilis. Hair and iris brown. Pupils rather large, react well.

Vision.—Right eye, counts fingers at 4 metres. Sn. 0.5 at 8 *cm.* -9 D $= \frac{6}{24}$. Left eye, $\frac{6}{60}$. Sn. 0.5 at 14 *cm.* -9 D $= \frac{6}{24}$; with -9 D before both eyes he reads $\frac{6}{12}$. No astigmatism. Quick lateral

nystagmus. Central color-sense normal. Light-sense: opening having a diagonal of 12 *mm*, L = $\frac{1}{36}$, after adaptation of 15 minutes and one hour. Ophthalmoscopic examination shows the fundus tessellated as in Case 1. Vessels perfectly normal. A large conus downward and outward from the papilla, which has an oval appearance. No pigment or white spots. No signs of choroidal disease.

Case 3.—Johann Lehr, aged eighteen; apprentice to hat-maker, gives the same history of night-blindness as the others. Fairly intelligent. General examination negative. Hair and iris dark brown. Pupils normal.

Vision.—Right eye, $\frac{6}{24}$. Skiascopy shows no refractive error. Left eye, $\frac{6}{18}$, $\frac{6}{12}$. Skiascopy shows slight hypermetropia. Both eyes, $\frac{6}{18}$. Sn. 0.5 at 10–25 *cm*. Ophthalmoscopic examination shows fundus to be very similar to Case 2. Vessels normal. A large conus downwards. No signs of pigment or white spots. Hemeralopia. A diagonal of 10 *mm*. L = $\frac{1}{24}$, after 15 minutes and after one hour adaptation. Central color-sense normal.

Case 4.—Richard Schweiger, age thirteen years. General health good. Night-blindness as in the others, but seems to have been a little less marked. Fairly intelligent. Hair and iris dark brown. Teeth good. Pupils large, react well to light and accommodation.

Vision.—Right eye, $\frac{6}{36}$, with — 2 D = $\frac{6}{18}$. Left eye, $\frac{6}{24}$, with — 2 D = $\frac{6}{18}$. Sn. 0.5 at 5–20 *cm*. Central color-sense normal.

Hemeralopia, 12 *mm* (L = $\frac{1}{36}$) after adaptation of fifteen minutes and one hour. Ophthalmoscopically the fundus is tessellated, especially in the neighborhood of the papilla. A conus downwards and outwards nearly two thirds the diameter of the papilla, which is obliquely elliptical. Vessels normal. No deposit of pigment and no white spots seen.

Karl Hauer, brother of Johann, Case 2., is myopic; with — 9 D. Vision is $\frac{6}{18}$. No color-blindness. Field of vision normal for white and colors. No hemeralopia. L = $\frac{1}{4}$. In the fundus are several small spots of choroiditis in different parts, not in the macula.

This case is mentioned because it is the only one showing ophthalmoscopic signs of disease, yet the patient is entirely free from the subjective symptoms of the others, and also because it is stated that hemeralopia occurs in connection

with myopia, and this patient being as myopic and as amblyopic as the others had no hemeralopia.

CASE 5.—Russian Jewess, age thirty-seven years. Sophie M——. Consulted Professor Fuchs with regard to symptoms of hyperæsthesia retinæ, and at the same time disclosed a condition which is unusually interesting. The family history is as follows: Her father lost an eye with glaucoma. The mother has had a cataract for fifteen years. A brother of the patient's father became gradually blind, and one of his daughters, aged fifteen, is blind, and, the patient thinks, was born blind.

The patient and two older sisters are night-blind. One is forty-two, the other forty years old. The night-blindness is in both congenital and has made no progress. Besides these there are three brothers and two sisters who have had no trouble with their eyes.

Madame M. has been married fourteen years and has three children living—one died at eight months with convulsions—who have had no symptoms of eye disease. No night-blindness.

One sister has had nine children, another three, all of whom are free from symptoms referable to the eyes. One brother has seven children free and another nine. The last married a second time, a cousin, and from this marriage came six of the nine children. The mother had external strabismus, as did her father to a still more marked degree, and three of the six children have it also. The grandparents were not related, and there is no knowledge of disease of the eye previous to the generation of the patient's father.

Several members of the family have died of phthisis. No symptoms pointing to syphilis can be made out. The patient has suffered with rheumatism for a number of years. At present she is hypochondriacal and somewhat hysterical, and complains chiefly, in addition to the hemeralopia, of being dazzled by bright lights and of headache and sense of fatigue after continued use of the eyes. These symptoms have varied with her general health. She is positive, however, that the night-blindness has been stationary. Ophthalmoscopic examination made by Professor Fuchs. Iris blue-gray. Pupils normal in size and reaction.

Right eye.—The papilla of normal color, sharply defined. Outward there is a rather well marked choroidal ring. The retinal arteries are distinctly narrow, the veins of normal calibre. The fundus otherwise normal, evenly red.

Left eye.—Outward from the papilla is a small atrophic conus which is not separated from the rest of the fundus by a sharp edge. The inner half of the papilla is bounded by a black, sharply defined choroidal ring. Vessels and fundus otherwise the same as the right eye.

Vision.—Right eye, $\frac{6}{12}$, + 1.5 D cyl. axis 30° nasal = $\frac{6}{6}$ + 4 D = Sn. 0.5 in 11 *cm.*

Left eye $\frac{6}{36}$, — 5.50 D spher. ⌒ — 0.5 D cyl. ax. 40° T = $\frac{6}{6}$, (?). Sn. 0.5 in 20 *cm.*

The photometer showed the degree of hemeralopia to be equal to 10 *mm* on the scale (L = $\frac{1}{25}$) after 20 min. adaptation.

It will be interesting to study the symptoms which are common to these five cases.

In all there is moderate night-blindness. The term light-sense is used here as Förster used it, namely, the acuity of vision in relation to the degree of light. In reality one gets a result with the photometer nearly equivalent to the least perception of light (Reizschwelle—irritation threshold), the exact determination of which is extremely difficult and clinically impracticable. The perception of minimum differences (Unterschiedsempfind lichkeit), does not enter into the question, if we may rely on the results of numerous examinations by Bjerrum,[1] who found that in all forms of night-blindness the perception of the slightest difference of light was normal. In three of the cases described above, the perception of difference was normal as compared with my own eyes. The other cases were not examined. The method used was a very simple one, based on the principle of Rumford's photometer. It was kindly suggested by Dr. Moritz Sachs, of Vienna. Two shadows of any broad object thrown upon a plane white surface by two candles of equal intensity, and at the same distance from the surface, are of equal density. If one candle is moved farther away or nearer, its shadows will vary in intensity. The movement which produces a difference between the shadows just perceptible to a normal eye, is the unit with which the pathological is to be compared.

[1] *Graefe's Archiv*, vol. xxx., 2, p. 234.

The photometer, with a normal eye, required a diagonal of about 5 *mm* (L = $\frac{1}{1.11}$), without adaptation; after fifteen minutes' adaptation, L = $\frac{1}{1}$.[1]

As Schirmer says the degree of hemeralopia varies with the intensity of the preceding light for the normal unadapted eye, and also for the hemeralopic. The conditions were similar in these cases as regards the light, the examinations being made at the same time of day with the rooms moderately lighted, so it is fair to compare the results before and after adaptation, with the normal.

Schirmer[2] states that in hemeralopia due to various forms of choroiditis and retinitis pigmentosa and to glaucoma, after a sufficiently long time for adaptation, varying from one half hour to twelve hours, the sensitiveness to light reaches the normal. In the cases which I have examined, the sensitiveness to light improved as in the normal eye, the adaptation equalling about 3 *mm* of the Förster scale, in the first fifteen minutes, or less, and after that remained constant, not approaching nearer the normal. It was not possible to confine these patients for more than an hour to the dark room, but the results seem to show that the trouble depends on a diminished sensitiveness of the retina and not on the adaptation, which was apparently normal.

The central color-sense was normal in all of the five cases examined. The field of vision and the peripheral color-sense may be considered together.

CASE 1.—Whereas, with full daylight, the fields for white and red being normal and blue within the red, by diminished light, the field for white was not narrowed more than was the case in the check test; the colors, however, were in their normal relation to each other, blue being outside the red.

CASE 2.—With diminished light the outer limit for white was narrower than the normal, and the limits for colors still in their abnormal or inverted order. The field for yellow corresponded very closely to that for blue by daylight; with still less light, blue was lost first, red being still recognized.

[1] Treitel, *Graefe's Archiv*, xxxi., 1, p. 153, gives for the normal unadapted eye L = $\frac{1}{15}$ or $\frac{1}{30}$. It is possible that the preceding light was brighter or that there was some difference in the apparatus.

[2] *Deutsche med. Wochenschrift*, 1891, No. 3.

CASE 3.—With good light, normal periphery for white, the colors being much narrower and inverted. With diminished light, white being disproportionately narrow, as compared with the check test, red had become slightly narrowed concentrically, so that the limits for red and blue lay nearly together. The answers in this case and in Case 4 were sometimes contradictory with the lower degrees of illumination, and in repeated examinations the results were not always exactly the same, but the essential points which I have mentioned were constant. With good light, the field for blue and yellow corresponded almost exactly; with the least light, yellow was generally seen as white.

CASE 5.—The field for white by a good light was normal, except for a very slight narrowing at the outer borders in both fields. Red was somewhat narrow. Blue and yellow within the red, with green nearest the centre. With somewhat diminished light, the field for white not being narrowed for the normal eye, in the case of the patient, the outer limits were slightly narrowed, and the limits for colors much more; in the right eye, red and blue falling together at 10° upward, outward, and inward, and at 7° downward. And for the left eye with the same light, the periphery for white was a little wider than the right, and the colors were narrowed concentrically almost to the fixation point.

With light still more diminished to a point just short of that with which the patient abruptly ceased to see the fixation point of the perimeter, the patient's peripheral perception of a 20 *mm* white object was $\begin{matrix} & 35 & 30 & 35 \\ 40 & & R & & 42 \\ & 50 & 45 & 45 \end{matrix}$, while the observer's with the same light was $\begin{matrix} & 50 & 50 & 55 \\ 50 & & R & & 65 \\ & 55 & 60 & 60 \end{matrix}$.

With this light the patient could not recognize colors at the centre; with slightly brighter light, red and green were recognized first, blue and yellow simultaneously with a degree of light still a little more intense.

These cases have in common, by daylight, normal field for white; normal or slightly narrowed for red. For blue and yellow—the colors falling almost together—margins within the red, with green in its normal position or perhaps

a little narrowed. By diminished light, the periphery contracted in proportion to the light more rapidly, in all but Case 1 than in the normal eye examined under similar conditions. The fields for colors contracted more with diminished light than that for white.[1]

In Cases 1 and 3, with diminished light the colors regained their normal order. In Case 5 they were no longer inverted, but the fields for red, blue, and yellow coincided.

In Case 2 the order was still inverted.

I have found this inversion of the colors in several cases of idiopathic hemeralopia, with normal field for white, the colors returning to their normal order after recovery in two cases which were kept in the dark for several days.

In one case of retinitis pigmentosa in a young man whose parents were related but with no history of heredity, the margin for white was at 20°, and for red at 10°, with blue at 5°. In this case the pigmentation was very marked and characteristic, extending almost to the centre. The vessels small, and there was partial atrophy of the opticus.

Séggel[2] found this color anomaly in the case of two brothers, in whose family night-blindness had occurred during three generations. The field for white was normal, for blue diminished, falling with the red between 30° and 40°.

In both cases there were irregularities of the pigment in the fundus, and the arteries were small. Leber[3] alludes to its occurrence in idiopathic night-blindness; Mauthner[4] found a blue-blindness in glaucoma, which he associates with choroiditis of the macula region as opposed to the red-green defect more characteristic of optic-nerve disease. In glaucoma also, hemeralopia is a familiar symptom. Macé and Nicati[5] have found blue-blindness in icterus, and con-

[1] Leber (*Graefe-Saemisch*, v., p. 647) mentions the relatively narrower field for colors than for white, and ascribes it to the weaker intensity of the colors. In this sense it would be characteristic of all forms of hemeralopia, and not, as Treitel (*Arch. f. Ophthalmologie*, xxv., 3, p. 35) is inclined to think, a symptom peculiar to retinitis pigmentosa.

[2] *Bericht über die Augenkrankenstation des Garnison-Lazareth's*, München, 1884, p. 108.

[3] *Graefe-Saemisch*, v., p. 998.

[4] *Die Lehre vom Glaukom*, p. 190.

[5] Nagel's *Jahresbericht*, 1881, p. 143.

sider night-blindness to be a form of blue-blindness. In detachment of the retina[1] the fields for colors may be most irregular, but, as a rule, blue is badly seen, and often confused with green, and *vice versa*.

In the cases of congenital night-blindness which I have examined, the central color-sense has been normal, the defect occurring only in the periphery, and green and blue were not confused.

It would be a rash conclusion to draw from these instances, that night-blindness and blue-blindness are intimately associated, but their frequent coincidence is certainly suggestive.

The following case which I have examined recently is interesting in this connection.

Edward Urbanetz, aged fifty-three, painter. Family history negative. No consanguinity. The patient has eight healthy children. Fourteen months ago his house was burned, and he was greatly frightened and exhausted; he was in intense heat, but was not burned. At first he noticed nothing the matter with his eyes, but in a few days observed that he saw badly in a dim light; this has increased steadily and is now extreme. He does not think that his vision by bright light has deteriorated much. Formerly colors were seen and differentiated with accuracy as his trade required; since the beginning of his trouble, he says that he has had difficulty in telling the darker hues of green and blue apart in a poor light.

Patient denies having had syphilis, and does not drink or smoke to excess.

Examination shows aortic and mitral lesions, the liver is enlarged and tender, he has had œdema of the feet and probably ascites, but at present there is no fluid in the abdominal cavity. Color is sallow, the conjunctiva being slightly yellowish.

Vision, $+ 1.25$ D $= \frac{5}{15}$. Field of vision, right eye:

	Up.	U.O.	Out.	O.D.	D.	D. in.	In.	In up.
White.....	50	70	70	80	60	45	55	60
Red.....	15	35	35	30	12	20	15	15
Blue..	8	10	10	10	10	12	10	8

[1] Dimmer, "Beiträge zur Pathologie der Netzhautablösung," *Wiener Medizinischen Presse*, 1886.

Outwards, blue was named green nearly ten degrees before being recognized as blue. Yellow followed blue quite closely. Green was seen only five degrees or less from the fixation point. Color test with Holmgren's wools showed no defect.

The field for the left eye was approximately the same.

The hemeralopia, without adaptation, with fifteen minutes, and after forty-five minutes' adaptation, was greater than could be measured with the Förster photometer (diagonal 50 *mm* L $< \frac{1}{1000}$). The perception of differences of light normal, as compared with my own. Ophthalmoscopic examination showed the fundus to be normal, except that the arteries were a little small and the papilla perhaps a trifle pale. No pigment changes.

There is no xerosis of the conjunctiva. Tension normal. It is safest to associate the night-blindness and the peripheral blue-blindness with the disease of the liver, but the case will repay further observation.

Wolffberg[1] states, as a result of numerous examinations, that in all true hemeralopia, in choroiditis, and in separation of the retina, never in glaucoma, he has found the blue within the red. If the choroiditis was circumscribed, the color anomaly corresponded to the diseased area.

Unfortunately, he does not mention retinitis pigmentosa. Wolffberg associates it with abnormal conditions of the pigment epithelium. On the other hand, Raehlemann[2] states that in the atrophy of the optic nerve which accompanies retinitis pigmentosa, but which is found often where there is no pigment, with a dirty yellowish, blurred disc and narrowed vessels, the light-sense being diminished, he has discovered no disturbance of color-sense. Treitel,[3] in ten cases of retinitis pigmentosa, found no such anomaly as the one under discussion. He says that congenital color-sense anomalies occur frequently in retinitis pigmentosa. Blue was confused with green. In one case green was seen farthest in the periphery, with blue and red in normal relations to each other, while in another, with blue and red normal, green was narrowed considerably.

Treitel[4] states, finally, that in diffuse inflammation of the

[1] *Graefe's Arch. f. Ophthalmologie*, xxxi., 1, p. 78.
[2] *Graefe's Arch. f. Ophthalmologie*, xxi., 2, p. 37.
[3] *Graefe's Arch. f. Ophthalmologie*, xxv., 3.
[4] *Loc. cit.*, p. 20.

retina and choroid, as well as in intraocular neuritic processes, the outer limits of the fields for colors are normal, as a rule, and retain their normal positions in relation to each other, and quotes Leber and Schön and Stilling as having the same opinion.

Ophthalmoscopically, our cases have no pigment deposits in the retina. The pigment epithelium was normal. No white points or signs of choroidal disease.

In three cases, 2, 3, and 4, there was a large conus downwards, or downwards and outwards,—the congenital conus.

In two cases the arteries were narrow; in Case I. very slightly, and only in one part of the retina and in one eye. In Case 5 all of the retinal arteries were uniformly narrow.

In four cases, belonging to one family, there was decided amblyopia.

The cases of congenital night-blindness hitherto reported are few in number and not given in detail.

A brief consideration of the literature of the subject will be interesting.

In several of the cases the literature is not easily accessible, so I have taken the liberty of quoting at some length such cases as seem to present points of especial interest. Let me take this opportunity to thank Dr. Sédan of Toulon, Dr. Moore of Dublin, and Dr. Waller Zeper of Haarlem, to whose kindness the following notes are partly due.

Little need be said of the cases from the pre-ophthalmoscopic time—Richter, 1828; Cunier, 1838; Stievenart, 1847—which are interesting, but not available for statistical purposes.

Donders also, unfortunately, does not describe the ophthalmoscopical appearances of his case, reported in 1854, but Maes mentions it with his cases in which the eyes externally and internally appeared normal, distinguishing them from the other class which he describes, and which is clearly retinitis pigmentosa.

Donders.[1] Male, sixteen years. Hemeralopia is extreme. "In moderate darkness, where others still see the passers-by, he does

[1] *Nederland Lancet*, May and June, 1854.

not see them. By diminished light he was unable to see a white shirt front while I could still count fingers. . . . The torpor retinæ was strongest in the neighborhood of the visual axis, and perhaps existed only there. He remarked that often he had only seen a tree in the evening as he passed it and not directly in front."[1] This phenomenon was not present in the cases reported above. Father and two brothers were similarly affected. Three younger children are free. The condition was stationary and congenital.

Maes[2] examined a brother of Donders's patient, nineteen years old. Vision by good light normal. Both eyes externally normal. Ophthalmoscopically the media are clear and fundus normal. No abnormal narrowing of field by diminished light.

Maes also examined a schoolmaster with myopia. Fundus, except for conus, normal. Slight nystagmus rotatorius. Field not narrowed in diminished light. The patient was one of a family of eight, of whom two brothers are night-blind. It also occurs congenitally in the family of his aunt, his mother's sister.

Förster.[3] Male, fourteen years. Ophthalmoscopic examination, negative. Night-blindness, moderate in degree, congenital, not progressive. Field of vision by daylight and diminished light is normal. A brother is also affected in the same way. Consanguinity and heredity not mentioned.

Swanzy[4] gives the history of a family of ten, five brothers and five sisters, of whom three sisters and two brothers are night-blind. The condition was congenital and stationary. No history of consanguinity of the parents nor of heredity. Two brothers and one sister were examined, the conditions being similar in all, only differing in the degree of hemeralopia. One patient was slightly hypermetropic, another myopic, and the third emmetropic. No color-blindness. The ophthalmoscope showed nothing abnormal.

As in Donders's case, the night-blindness was strongest in the neighborhood of the visual axis.

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[1] The superiority of peripheral vision over central might suggest a central scotoma, except that patients with central amblyopia see better by diminished light, while here the reverse was true.

[2] II. *Jahresbericht der Utrechter Augenklinik.*

[3] *Ueber Hemeralopie und die Anwendung eines Photometers*, Breslau, 1857. The three doubtful cases mentioned by Förster are not congenital night-blindness, and if the definition which I shall give be allowed, they cannot be transitions-forms as Leber styles them, but must be otherwise classified.

[4] *Irish Hospital Gazette*, March 15, 1872.

A characteristic which occurred also in the cases examined by the writer is thus stated by Mr. Swanzy: "There is a point in the decreasing daylight up to which the patient can see well even to read the smallest type, but beyond which his eyes become suddenly almost useless to him."

Two of the sisters have, at different times, suffered with hyperæsthesia of the retina. One of them, who also had night-blindness, avoiding bright lights, and the others, without night-blindness "was laid up for a lengthened time with a severe attack of hyperæsthesia of the retina of that form, it would seem, which is unattended with defects of the field of vision but accompanied with subjective appearances of light and colors."

Fitzgerald.[1] Rev. Mr. ——, age thirty-five. Night-blind as long as he can remember. The condition has always remained the same. There were fourteen brothers and sisters, two still-born, most of the others died young, "water on the brain" being the cause assigned for the majority. Three sisters are living, of whom one is night-blind, as well as a distant cousin on the mother's side. "The patient always enjoyed good health except that he suffers from psoriasis palmaris." Myopia $\frac{1}{3}$. Field of vision and ophthalmoscopical appearance normal. Color-sense normal, except that in the right eye there was a crescentic-shaped portion at the inner side of the visual field, extending from the margin to within a short distance of the centre in which green appears brown and vermilion the same though somewhat darker. No consanguinity.

(The possibility of an inherited syphilitic taint suggests itself here, and it would have added to the value of the case if more than one member of the family had been examined.)

H. Pagenstecher[2] examined two members of a family with congenital night-blindness, and gives a genealogical tree showing the transmission through five generations.

Those affected were always males; eight out of thirteen. Consanguinity not mentioned. Night-blindness extreme. Vision myopic in one case, in the other emmetropic. Field of vision by diminished light disproportionately narrowed. Color-sense normal. Fundus appears normal. General health good.

Dr. Sédan[3] reports the case of an officer with marked night-

[1] *Irish Hospital Gazette*, Jan. 15, 1873.
[2] *Centralblatt für Praktische Augenheilkunde*, 1878.
[3] *Receuil d'ophtal.*, 1885, p. 675.

blindness without ophthalmoscopic changes and without narrowing of the field of vision or anomaly of color-sense, and especially with no trace of retinitis pigmentosa. The condition was congenital, stationary, and there was no history of consanguinity.

Genealogical tables are given of two families. In the first are seventeen members, seven females and ten males. Of these twelve were night-blind, namely, five females and seven males. In the second family, among eighteen members, five females and four males were night-blind.

Dr. Sédan has very kindly allowed me to state the history of these families since the publication of his article in 1885. This brings the transmission to the fourth generation in the first family with three boys, two of whom are night-blind. And in the second family in the fourth generation, three children not night-blind are added to the three given by the author, who were night-blind.

Leber[1] gives a detached case. Female, twenty years. Congenital night-blindness. Not mentioned whether stationary. No other members of family affected. Parents related. Field of vision by daylight free. Color-sense not mentioned. Vision, My. $\frac{1}{5}$. R. $\frac{8}{10}$, L. $\frac{5}{10}$. Ophthalmoscopic examination shows a posterior staphyloma, slight decolorization in the macula, with a few irregular dark spots. Optic nerve and vessels normal

Nettleship.[2] Male. Age sixteen. Night-blindness, probably congenital, not progressive. Vision $\frac{6}{18}$, not improved by glasses. Fields slightly narrow by lamplight. Ophthalmoscopical appearances perfectly normal. No family history of similar complaints. No consanguinity of parents.

Records of ten families have been given and of two isolated cases, making in all fifty-four cases, thirty-six males and eighteen females. Consanguinity is only mentioned once, Leber's case. In two of the families only males were affected. The transmission is through both male and female ancestors. In the family Wenzel which I have reported, the transmission was three times carried over two generations, the females being exempt.

In two families the condition has been transmitted through five generations with little diminution of its intensity. This

[1] *Graefe-Saemisch*, v., p. 650.

[2] "Some Forms of Congenital Amblyopia," Group 7, Case xxvi. *London Ophthalmic Hospital Reports*, vol. xi., part 4.

suggests the interesting possibility of tracing the family Nougaret, reported by Cunier, the members of which are probably still to be found in the neighborhood of Montpellier, thereby establishing the identity of the condition by means of the ophthalmoscope.

In addition to these typical cases, let me note three of a less definite nature.

Stanford Morton [1] gives the history of a family with hereditary night-blindness, transmitted through six generations. Only the males were affected. The two members examined had very narrow fields of vision. Fundus normal. One member of the family whom Mr. Morton did not examine had "progressive myopia, irregularly scattered pigment at the periphery, and night-blindness." This, with the narrow fields of vision, casts a doubt upon the nature of the condition, although the pigment is said to be not at all typical of pigmentary retinitis.

Heinrich Kornitzer, forty-two years, came to Professor Fuchs in 1881 with congenital stationary night-blindness.

Vision.—Both eyes, $\frac{6}{24}$. With weak concave glasses, $\frac{6}{18}$. Sight has not become worse. Eyes externally normal. Slight oscillating nystagmus, especially at the ophthalmoscopic examination. Fundus normal. There is concentric narrowing of field for white. Central color-sense normal. Photometric examination, $L = \frac{1}{18}$.

There are thirteen brothers and sisters. Four who are dead had good sight. Of the nine living three are night-blind—the patient, a brother two years older, and a sister fourteen years younger. The patient, as well as his brother and sister, have children whose sight is good. There is no consanguinity. Unfortunately it was impossible to trace this family; so that on account of the narrow fields of vision, in spite of the normal appearance of the fundus, it seems best not to assign them to any class because of the lack of evidence.

Night-blindness is a symptom occurring early in retinitis pigmentosa, possibly preceding the visible changes, but not constant, and not in itself sufficient to establish a diagnosis of that disease; occurring also *in choroiditis*, in glaucoma, in detachment of the retina, in various diseases of the liver, in

[1] *Transactions of the Ophthalmological Society*, 1893.

pregnant women, after hemorrhage, as an acute disease, and, as is here assumed to be the case, as the result of a congenital malformation. It is hardly necessary to say that all of these causes, although acting on the retina in quite different ways, may produce the same effect.

It is the conviction of the writer, though not at present susceptible of absolute proof, that this condition should be classed with the congenital anomalies or malformations rather than with the diseases, properly so called, resulting from inflammatory or degenerative changes.

The absolute unchangeableness, the association in several cases with the congenital conus and with marked amblyopia, and the fact that in none of the families reported is there a single instance of a variation of the type, which would certainly be the case if the condition were of inflammatory origin, are reasons for this view.

One meets the doubt frequently expressed as to the actual existence of this condition independently of retinitis pigmentosa.

Before the day of the ophthalmoscope night-blindness and torpor retinæ were all-embracing names. Since then, with the swing of the pendulum from the empirical and symptomatic to the exact and pathological extreme, most cases which have pigment in the retina, and many which have none, have been called retinitis pigmentosa. It is true that an exact classification either from a symptomatic or a pathological standpoint is at present impossible; but the vague, though often convenient, term atypical retinitis pigmentosa can and should be narrowed as advances in our knowledge give us clearer insight.

Retino-choroiditis, generally of syphilitic origin, has been more or less clearly differentiated. The retinitis punctata albescens of Mooren has a distinct identity.

Nettleship[1] describes a group of cases which clinically is very like pure congenital hemeralopia, except that the field of vision is somewhat contracted by daylight, and in all of the cases there was more or less marked retino-choroidal change.

[1] *Ophthalmic Hospital Reports*, vol. xi., part 4.

A small but interesting group is also described by Nettleship[1] as probably the result of a retrobulbar neuritis forming a large and ill-defined central scotoma, having day-blindness, total color-blindness, and, in some of the cases, the ophthalmoscopic signs of retinitis pigmentosa.

More or less persistent night-blindness may follow acute infectious diseases, probably as a result of retinitis or retinochoroiditis, with very slight ophthalmoscopic change, as in the cases of Dor[2] and Hersing.[3]

One meets the statement that retinitis pigmentosa without pigment is not a rare occurrence, but I have been able to find only a few cases in the literature, which, for the sake of comparison, are given in tabulated form. In addition to these it is stated that Galezowski[4] has reported such cases, and Schmidt[5] states that one case of retinitis pigmentosa without pigment was seen in the Bonn clinic from 1883 to 1890; the case, however, is not given in detail.

It is probable that the earliest change visible with the ophthalmoscope in typical retinitis pigmentosa is the irregularity of the pigment epithelium. What precedes this we do not know. The nutrition of the deeper layers of the retina is perhaps in some way affected either through the choroidal or retinal blood supply.

The post-mortem examinations have been made upon eyes which are in an advanced stage of the disease, when it has lost what distinctive character it may have had and is indistinguishable from other forms of chronic retinochoroiditis.

Until pathological research or experiments on animals throw some new light on the subject we must view it from a purely clinical standpoint.

A conclusion that seems inevitable after reviewing the cases of retinitis pigmentosa and especially of congenital amblyopia is that the pigment changes are part of a general degeneration involving the retina, choroid, optic nerve, to

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[1] *Ophthalmic Hospital Reports*, vol. xi., part 4.
[2] Dor, *Arch. d'ophtalmol.*, 1883.
[3] Hersing, *Graefe's Archiv*, xviii., 2, p. 69.
[4] Galezowski, *Recherches ophtalmoscopiques*, etc., p. 22, Paris, 1863.
[5] Ernst Schmidt, "Über Retinitis pigmentosa." *Inaugural Dissertation*, Bonn, 1880.

	Pigment.	Vessels.	Optic nerve.	Central vision.	Peripheral vision.	Color-sense.	Hemeralopia.	Course.	Heredity.	Consanguinity.	
Darier, 1887. *Arch. d'opht.*, t. vii., p. 173. (Case 4.) Male, 18 yrs.	No pigment deposits in the retina.	Very small.	Dull red.	R. $\frac{1}{3}$. L. $\frac{1}{3}$.	Narrowed.	?	?	Probably progressive.	Grandfather blind at 30.	o	Case 4 is unquestionably retinitis pigmentosa without pigment. The diagnosis of the case alone would be probable, and it is made certain by the typical retinitis pigmentosa in the brother.
Darier. (Case 5.) Brother of Case 4, age, 31.	Choroidal atrophy around the papilla; a little pigment of typical shape in the periphery.	Small.	Dull red.	R. $\frac{1}{10}$. L. $\frac{1}{10}$.	$\frac{1}{3}$ narrower than normal.	Poor.	o				
Darier, *loc. cit.* Male. (Case 6.)	No typical pigment; 2 or 3 small black points along the vessels.	Very small.	Dull reddish gray.	R. $\frac{1}{3}$. L. $\frac{1}{10}$.	Very narrow.	Good.	Began at 5 yrs.	Gradually progressive.	o	o	The patient and two brothers, who died in infancy have six fingers and toes. A brother of his mother has a coloboma of the iris, and sees badly.
Hocquard & Poncet, *De la rétinite pigmentaire*, Paris, 1875. *Ann. d'Ocul.*, t. lxxiv, p. 234. Male, 21 yrs.	In one eye one pigment spot, in the other, 2 or 3.	Small.	Gray.	Poor.	Narrow.	Good.	Congenital.	?	Three ancestors.	?	Poncet found at the autopsy a good deal of pigment in the deeper layers of the retina, which had not been visible ophthalmoscopically, "because the retina was œdematous" (the patient had died of scarlet fever). There was also advanced endarteritis of the retinal arteries.
Treitel, *Graefe's Archiv*, xxv., 3, p. 20. Male, 18.	No pigment. Slight chorio-retinitis in macula. Small circular conus around papilla.	Very small.	Atrophic.	High myop.	White normal; colors seen only in a narrow circle around fixation point.	Has always seen blue badly.	Congen.	Not progressive.	o	o	Possibly a neuro-retinitis of *intra-uterine origin.*
Huidiez, *Annal d'Oculist.*, t. lxxviii., p. 211. Child, 8 years.	Infiltration at the border of papilla. No pigment.	?	?	?	Considerably narrowed.	o	Probably congenital.		A cousin is also night-blind.	Consanguinity exists in both cases.	It is a pity that the ophthalmoscopic examination is so indefinite. The term "infiltration" conveys no definite idea.
Alvarado, *Centralblatt f. prak. Augenheilkunde*, October, 1882, p. 312. Male, 31 yrs.	No pigment; retina orange red.	Small.	White.	Myop.	Narrow.	?		Progressive.	?	?	Post. polar cataract. There seems to have been no night-blindness, and the diagnosis cannot be considered as established.
Guaita, *Nagel's Jahresbericht*, 1875, p. 386.	No pigment; pigment epithelium thin at periphery.	Thin.	Pale.	?	Field narrow outwards.	?	Since 4th year.	?	2 Sisters night-blind.	?	Stated in Nagel, *loc. cit.*, that this case is congenital hemeralopia. It seems rather to belong to the class of retinitis pigmentosa, but the diagnosis could only be made positively after examination of the other members of the family.

speak only of the eye. And it seems probable that the disease may show itself in any one of the three places and retain the character of disease of that portion almost to the exclusion of the others, or they may be combined in varying degrees. If the name retinitis pigmentosa be used in this sense it could be made to include forms of disease with very diverse clinical appearances. If with Wagenmann[1] we assume that retinitis pigmentosa comes from the choroidal side through disease of the ciliary vessels or of the capillaries of the choroid, then the atrophy of the nerve and retinal vessels would occur as a secondary change, as after other forms of choroiditis,—choroiditic atrophy of Gowers,[2]—although the choroiditis itself may escape detection and may even be with difficulty discoverable *post mortem*.[3] This, then, would explain many of the cases of so called atypical retinitis pigmentosa where the characteristic subjective symptoms are present with atypical ophthalmoscopic appearances. It also shows how gradual and almost imperceptible the difference may be between retinitis pigmentosa and choroido-retinitis, making all transition forms possible.

If narrowness of the retinal vessels with hemeralopia but without visible ophthalmoscopical changes in disc or epithelium is also to be considered as incipient retinitis pigmentosa, then such a case as No. 5 would have to be classed with the group of retinitis pigmentosa without pigment, but this is not proven, and all we can say for the present is that the normal field for white, the stationary and congenital character and the otherwise normal appearance of the fundus, point more strongly to congenital hemeralopia than the narrow arteries do to retinitis pigmentosa.

All attempts at an exact classification must seem from certain points of view artificial.

It is not to be denied that underlying some of these classes the same inherent tendencies probably exist, predisposing to malformations and degenerative changes or low-

[1] Wagenmann, *Graefe's Archiv*, xxxvi., 4., p. 1, and xxxvii, 1., p. 230.
[2] Nettleship, *Diseases of the Eye*, p. 191.
[3] Leber, *Graefe-Saemische*, v., p. 625.

grade inflammations. Of the determining causes we know nothing, and our conclusions can only be drawn from clinical observation and must be subject to future revision.

Finally, I have attempted to show that the night-blindness which is congenital, stationary, generally hereditary—and that to a greater degree than retinitis pigmentosa,—and not accompanied by signs of such disease as would in itself cause night-blindness,[1] is a condition depending upon a malformation of the deeper layers of the retina, probably of the pigment epithelium, the nature of which we do not know. Not being of an inflammatory or degenerative nature, there can be no question of transition or mixed forms between this condition and retinitis pigmentosa, such as are mentioned by Leber, Nuel, and others.

[1] It is possible to conceive of congenital night-blindness being present in an eye in which retinitis pigmentosa afterwards develops, but this is a purely theoretical consideration.

THREE UNUSUAL CASES OF RETINO-CHOROIDAL DEGENERATION.

REPORTED BY COLMAN W. CUTLER, M.D.

(From the Clinic of Prof. FUCHS.)

(*With drawings by* Dr. SALZMANN. *Pl. III. Vol. XXX. Germ. ed.*)

THE following cases were seen by Prof. Fuchs while the writer was studying the subject of night-blindness, and the opportunity to report them was most kindly given him.

The patients are three sisters belonging to a Bohemian family. The father is dead. It is believed that there was nothing wrong with his eyes. The mother was examined and found to have normal eyes. The parents were first cousins.

No other hereditary or congenital form of disease exists in the family. There is no nystagmus.

Seven children are living; three dead, two with diphtheria at an early age, making it impossible to say what was the condition of their eyes.

Of the seven living, four are males, twenty-three, twenty, sixteen, and twelve years of age, respectively. All have normal vision.

The three sisters are twenty-six, twenty-four, and twenty-one years of age. They have in common night-blindness, cataract, and the peculiar form of choroidal atrophy at the periphery bounded towards the disc by a lobulated margin of the normal fundus.

There are no signs of inflammation.

CASE 1.—Gisella Geyer, age twenty-six. Vision: Right, —18 D = $\frac{5}{24}$. Sn. 0.5 at 6 *cm.* Left, —20 D = $\frac{5}{24}$. Sn. 0.5 at 6 *cm.* Field of vision for both eyes considerably narrowed. The patient has three children, boys, with normal vision. She is a reddish blonde, the other sisters having brown hair.

In both eyes the iris is grayish blue. There is a small, almost round opacity at the post. pole of both lenses, without branches. There is no strabismus. The patient has been subject to fainting. The ophthalmoscope shows in the right eye (see Fig. by R. A. on Plate III.) a large staphyloma surrounding the disc, with peculiar lobulated protrusions, surrounded by normal fundus, and farther to the periphery a uniform zone of atrophy.

The edge of the staphyloma and of the atrophic zone are equally sharp in outline and partially marked with pigment. The fundus between the atrophic zone and the staphyloma is quite normal. The atrophic zone appears almost uniformly white, with a very few choroidal vessels near its inner margin; farther toward the periphery it is covered with a dense network of large, intensely black pigment, so thick that several parts of the periphery are almost black.

The left eye is nearly the same except that the branches or lobules of the staphyloma connect downwards with the peripheral atrophic area (see drawing Gisella G., L. A., Plate III.) The upper part of the fundus shows near the edge of the atrophic area several small round white patches, while in the other cases the atrophic areas are always confluent.

CASE 2.—Irma Prohaska, age twenty-four. Vision: Right, perception of light at 1 *m*, outwards and inwards, not at the centre. Left, light perception, 5 *m*. Projection outwards and inwards good; upwards and downwards, uncertain. At eight years the patient could still go to school. At eleven she began to complain of night-blindness and to squint. She now has a high degree of external strabismus. For the past three or four years no change has been noticed in the vision. In both eyes, most marked in the right, there are many punctate opacities in anterior and posterior cortical layers, more numerous at the poles, forming there dense opacities.

The whole fundus shows atrophic choroid except at one place, outwards from the papilla. This place is two or three times larger than the disc, red, and surrounded by black pigment. In the central parts of the atrophic zone there is a little pigmentation

of the fundus; towards the periphery are some larger masses of pigment, and some smaller deposits which are mostly branched.

The disc shows a high degree of atrophy. Right eye about the same, but because of the opacity of the lens the fundus cannot be distinctly seen.

CASE 3.—Rosa Prohaska, age twenty-one. Vision: Right, counts fingers at 2 *m.* Sn. 2.25 with difficulty. Field of vision considerably narrowed concentrically. Left, —10 D = $\frac{5}{60}$. Sn. 1.5 at 10 *cm.* Field slightly narrowed concentrically. For the past five or six years the patient has seen badly evenings and cannot venture in strange places at dusk. She reads in the shadow, when the book is well lighted, better than in the sun. There is marked external strabismus of the right eye. In both eyes posterior polar cataract in form of a delicate star with seven rays and darker centre.

Right eye.—The papilla is surrounded by a staphyloma which is continuous at one point with the peripheral atrophic zone, then follows the normal fundus as in Case 1, and the atrophic choroid for eight or ten papilla diameters to the periphery.

The outer or atrophic zone shows towards the normal fundus most of the larger vessels of the choroid, towards the periphery it becomes more and more uniformly yellowish and shows the vortex veins with unusual distinctness. The pigment epithelium has disappeared and there are round and branched and in some places very large and intensely black spots in this area. The disc is slightly atrophic.

Left eye.—Color of disc less atrophic than right. Large staphyloma outwards, nowhere connecting with the peripheral atrophic zone (see Fig. Rosa P. on Plate III.), which is not quite so large as in the right eye, but otherwise the same.

The right iris is grayish blue, the left the same, with some brownish pigment spots.

A similar case has been reported by Jacobson,[1] under the name of atypical retinitis pigmentosa.

The patient was a man of twenty years. The fundus was comparatively normal for a distance of two or three papilla diameters from the disc, this being bounded by a lobulated, somewhat pigmented, sharply defined margin, outside of which the choroid is

[1] Zehender, *Monatsblatt*, 1888, p. 202.

atrophic nearly to the limit of the visible part of the fundus, but less completely so at the extreme periphery, being there interspersed with patches of normal fundus. Optic nerve pale, vessels narrow. In the atrophic zone and extreme periphery numerous pigment deposits along the course of the vessels, such as are characteristic of retinitis pigmentosa. The condition had existed since childhood and was progressive. Night-blindness marked. Field of vision concentrically narrowed. Color-sense normal. The patient was mentally somewhat deficient. The father of Jacobson's patient had been blind for a year and a half and night-blind since childhood. Ophthalmoscopically there were signs of a typical retinitis pigmentosa with white areas in the periphery as in the son, but no continuous zone of atrophy.

Mauthner[1] has described a case of almost complete absence of the choroid, which deserves mention in this connection.

Male, thirty-two years. Has always seen badly and has been night-blind since childhood, but the condition has grown worse in the last fifteen years, since an attack of typhoid fever. Vision, R. $\frac{5}{200}$, My. $\frac{1}{12}$. Field concentrically narrowed, temporal side absent, greatest dimension vertical 20°. L. V. $\frac{10}{40}$, My. $\frac{1}{16}$. Field failing downwards, greatest dimension 34° horizontal. The ophthalmoscope showed in both eyes the fundus glistening, greenish-white, optic disc round, margins indistinct, retinal vessels somewhat narrow, otherwise normal.

The fundus shows only a few normally shaped choroidal vessels such as appear in colobomata, and small masses of pigment. Only in the macula is seen a net of choroidal vessels, while in the left eye this place is marked by a sharply defined reddish-brown, rhomboidal area. Here the pigment covers the vessels which are first visible farther out.

Of this case Leber[2] says: "The case of Mauthner described as choroideremie may be pigmentary atrophy of the retina complicated with extreme atrophy of the choroid."

We have, then, five cases, or with Mauthner's, which, from a certain point of view, belongs to the same group, six,

[1] *Berichte des Naturwissenschaftlich-Medizinischen Vereines*, Innsbruck, II. Jahrgang, 2 u. 3 Heft p. 191.

[2] Nagel's *Jahresbericht*, 1872, p. 316, and *Graefe-Saemisch*, v., p. 642,

which may be considered together and which give a fairly complete picture of the form of disease.

The older of Jacobson's patients is blind with retinitis pigmentosa, but the choroidal atrophy is slightly marked; his son is not blind, but the choroidal atrophy is more advanced and the condition is stated as progressive. These must be taken as less markedly atypical cases, not less advanced retinitis pigmentosa. In other words, we cannot look on the degree of atrophy as representing different stages in the development of the disease.

In logical succession follow Cases 1 and 3. In the former, in addition to the zone of total atrophy there are a few isolated patches of choroidal atrophy.

In Case 2 the choroidal atrophy is almost complete, the nerve is atrophic, and vision is almost abolished. If finally we take Mauthner's case of "choroideremie," we have a striking group which may be taken to represent different phases of the same condition. There is no evidence to show that they represent different stages of the atrophy. On the contrary, the impression given is that of a process which has run its course and reached a standstill.

The sharply defined and pigmented edge and the absence of signs of inflammation would point to the stationary character, while the lobulated edge and the occurrence in two cases of isolated patches would indicate that the choroidal atrophy was formed by the growth and confluence of such smaller areas.

If we assume that the atrophic condition is stationary, what can be said of the retinitis pigmentosa and of its association with the choroidal atrophy? That the retinitis pigmentosa is progressive must be assumed from the nature of the disease. In thus dissociating the two conditions we weaken the idea of unity which seemed the most plausible explanation, namely, that both the choroidal atrophy and the retinitis pigmentosa are manifestations of the same disease though occurring independently.

It is possible that in spite of the stationary appearance of the choroidal atrophy it may still be progressive either in a degenerative way without signs of inflammation or inter-

mittently, and in favor of this view must be considered the fact that in all of the cases the essential features of the atrophy were the same. This assumption suggests the possibility of our cases eventually reaching the condition of complete atrophy which Mauthner's shows, but this is purely an hypothesis.

With regard to the vision, these cases present problems which are equally hard to solve.

We may eliminate the cataract as the least important element, the remaining ones being the retinitis pigmentosa, with the optic atrophy and the choroidal atrophy, in that order.

The fields of vision, unfortunately, could not be taken with sufficient exactness to throw much light on the subject, but it is obvious that light perception was present in a part of the field corresponding to the atrophy. The myopia is probably secondary to the amblyopia and perhaps to degenerative changes, and the staphylomata may also be progressive, advancing to meet the peripheral atrophy.

It is possible only to touch upon the details of this complicated picture and our ignorance of the true nature of the disease is as complete as ever. We can only consider it a form of that large class of pigmentary degenerations, affecting the choroid to an unusual and excessive degree.

In closing, let me express my warmest thanks to Dr. Salzmann for the drawings of the fundus which he has allowed me to use and for his kindness shown in many ways.

A STRAIGHT ARM, CORRECTED SCALE, AND OTHER IMPROVEMENTS FOR JAVAL'S OPHTHALMOMETER.

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(*With 3 drawings in the text.*)

IN the October number (1894) of the *Annals of Ophthalmology and Otology*, Dr. G. W. Grove publishes an article entitled "Graduation of the Arc on Javal's Ophthalmometer; and Graduation on a Straight Arm." In this he does not claim any advantages for a straight arm over the arc, but rather admits its inferiority (page 366). And indeed that is quite correct for his procedure, because he simply projects the old graduation from the arc to the straight arm, which must necessarily give inaccurate results, as the transfer of the mires from the arc to the straight bar changes the whole calculation upon which the arc was graduated. But I advocate the superiority of the straight arm over the arc. Dr. Grove refers to an article of mine in these ARCHIVES (Jan., 1893), in which I state in a note that the arc of Javal ought to be replaced by a straight line. I did not at that time express any further opinion about it and have not published anything about the subject up to this time. But I was just then finishing my calculations for a straight arm, which I have employed since the spring of 1893,[1] making at the same time such mechanical changes

[1] At that time I had the pleasure of showing this modified instrument to Prof. H. C. Chapman and Prof. W. Thomson of the Jefferson Medical College of Philadelphia.

that both mires moved equally in opposite directions. The reason I had for introducing the straight arm was, first, because then the mechanism for the equal and opposite movement of the mires could be constructed more easily, and secondly and *mainly* because I wanted to increase the accuracy of the instrument, not for the purpose of prescribing cylinders but to make the corneal measurements as accurate as possible. However I did not simply project the graduation from the arc to the straight arm as Dr. Grove does, but I made new calculations altogether; because I objected to the use of an arc as being wrong in principle as will be shown

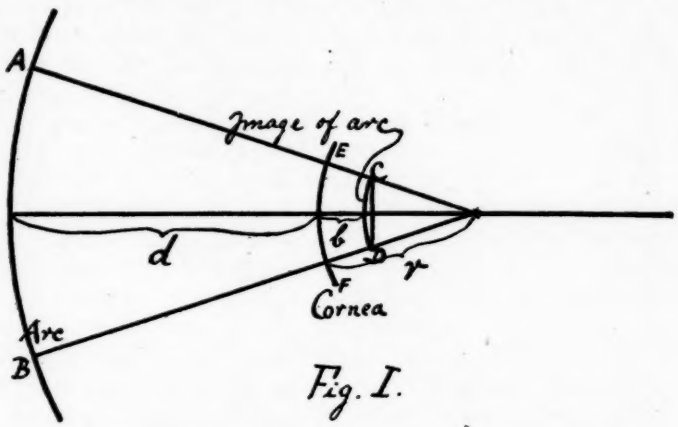

Fig. I.

now. Javal makes his calculations from the formula $\frac{1}{b} = \frac{1}{d} + \frac{2}{r}$ where the meaning of d, b, and r will be at once clear by reference to Fig. I. If further O is called the size of the *arc* $A\,B$, the image of which is the small *arc* $C\,D$ and is called $\mathcal{J}$, we have $\frac{O}{\mathcal{J}} = \frac{d + \frac{r}{2}}{\frac{r}{2}}$ Now Javal calls $d + \frac{r}{2}$ a constant, and uses it as such in his calculations. This of course is not quite correct as $\frac{r}{2}$ is variable; but the error does not amount to much and may be neglected from the present point of view.

However, the following inaccuracy is of much greater weight and cannot be accepted for accurate work. It arises from the use of an arc. It is true that a circular object,

like an arc, is the only object that gives a circular image on a spherical mirror; but it is just this fact which is a source of serious inaccuracy in the instrument. For the Wollaston prism gives a doubling of a certain fixed quantity, in my own instrument equal to 2.92 *mm*, and this is not measured along an arc, but on a chord. The *chord C D* (Fig. I.) alone is fixed by the arrangement of the lenses and prism, but not at all the *arc C D*, which by calculation may be easily shown to vary from 2.94 *mm* for a corneal radius of 10 *mm* to 3.03 *mm*, for a radius of 6 *mm*. In the formula, therefore, which is used by Javal $\frac{O}{\mathcal{J}} = \frac{d+\frac{r}{3}}{\frac{r}{3}}$, the quantity J is not fixed as he assumes, but is variable within 0.1 *mm*. Such a variability is not allowable; for the corneal image must be accurate within $\frac{1}{100}$ of a millimetre, as Helmholtz[1] says: "For the purpose of measuring the cornea one can only use images, which are considerably smaller than the corneal radius, not larger than one quarter of the size of the latter. One must endeavor to precisely determine these images to *the hundredth part of a millimetre*, if one wants to calculate accurately the corneal radius to the $\frac{1}{300}$ of its size." This applied to a radius of 8 *mm* would mean that the radius under these precautions would be accurate to $\frac{1}{100}$ of a *mm*. And that is not hair-splitting, because it corresponds to a quarter ($\frac{1}{4}$) of a dioptry, which we all like to get accurately. Thus it has been shown that Javal's instrument in its present construction cannot give us exactly the quarter of a dioptry.

It is for this reason that I have given up the arc and have substituted for it a straight arm. It is undoubtedly true that this straight bar has not a straight line for its image on the cornea. But that does not concern us here at all. All we have to consider is the place where the inner edges of the two mires have their images on the cornea—that is, how far these images fall—from the axis of the instrument. This is all that is necessary for our purpose, because if we then call *O* the straight distance between the inner edges of the two mires, which in our construction is perpendicular to the axis of the instrument, and if we call further $\mathcal{J}$ the dis-

[1] *Graefe's Archiv f. Ophth.*, i., 2, 1854.

tance between the two images, which is also measured at right angles to the axis, we have then conditions which allow of a rigid calculation, as $\mathcal{J}$ remains always the same. And, further, I did not only thus make $\mathcal{J}$ a fixed quantity, but I also employed formulæ which are more accurate than Javal's; for we must remember that the formula, before given, is not quite correct, if the object is very large with reference to the convex mirror and so near to it. What really happens can be perhaps best explained by reference to Fig. II. Here GH represents the cornea and AE the straight bar, while C is the centre of curvature of the cornea. If now A is a point on the straight arm, it is clear that only that ray from it can be seen by the observer which is reflected from the cornea at B into the telescope at E, in such a way that the angle of incidence ABH equals the angle of reflection HBE, called i in the diagram. All the other rays emanating from A and reflected from other parts of the cornea will not be seen by us, as they do not enter the instrument at E.

Now, it can be shown that each point A has in reality two images, or rather two focal lines on a reflecting curved surface, which are found by the following two equations:

$$\text{(I.)}\ \frac{1}{b} = \frac{1}{d} + \frac{2\cos i}{r} \quad \text{and} \quad \text{(II.)}\ \frac{1}{b_1} = \frac{1}{d} + \frac{2}{r_1 \cos i}$$

Here (I.) gives the focus for rays from A near B vertically to plane of paper, while (II.) gives the focus for rays from A that fall near B in the plane of the paper. The letter r denotes the radius of curvature of surface B vertically to the plane of the paper and r_1 the radius of curvature at B in the plane of the paper, this plane being supposed to be one of the two planes containing the two principal radii of curvature of the surface at B. This shows, then, that for very astigmatic or ellipsoidal surfaces, the difference between the two principal radii of curvature ought to be taken into account; but it is also seen that even for a spherical surface, where r and r_1 are alike, we get two focal lines, which are, however, lying so near to each other, that practically they may be considered as coinciding in mirrors of corneal dimensions.

We take here the formula (I.), because then the construc-

tion and calculation are so much easier. It will be seen at once that now d and b have a different meaning from what they had in the usual formula for central rays, and it is evident also that on the straight bar $A\,B\,(=d)$ is not equal to $E\,B$. This, indeed, is the case in Javal's arc, which therefore, in so far, would deserve the preference, if the variability of $\mathcal{J}$ was not against it. One might, however, avoid the variable $\mathcal{J}$ by calling O the distance of the mire from the axis of the telescope and then proceeding in the same way as was indicated before for the straight arm. This would

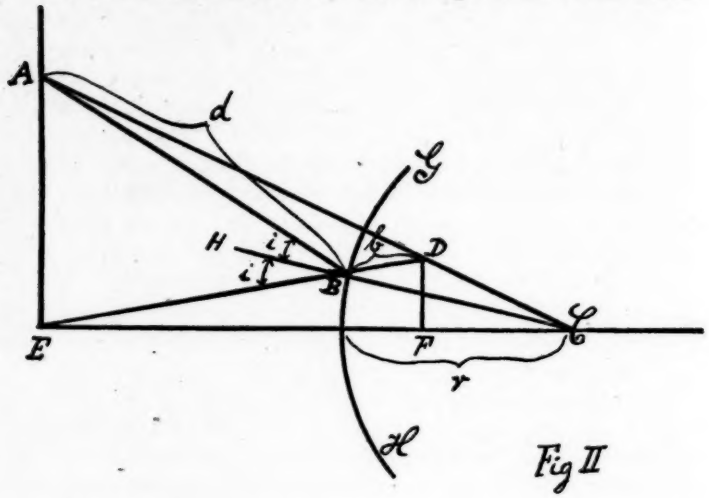

Fig II

also change the scale of the arc, but even that would not be quite correct, as it can be demonstrated that then for different O and r the arc of the instrument ought to be of different length. The calculation to prove this cannot be given here for want of space, but it rests in a great measure on the fact that, in Javal's instrument, $E\,D$ (Fig. II.) is a constant, on account of the fixed position of the lenses, owing to which the image can only appear clear when $E\,D$ is of a certain size. But if the straight arm is employed, the objection to the change of arc falls away, though the calculation is then more tedious. I make now use of the correct formula (I.),

$\frac{1}{\delta} = \frac{1}{d} + \frac{2\cos i}{r}$ where d, b, and r have the meaning indicated in Fig. II, and of the formula $\frac{o}{\mathcal{Y}} = \frac{d}{b}$, which follows from this if $\frac{o}{\delta} = A\,E$ and $\frac{\mathcal{Y}}{2} = D\,F$ of Fig. II.

I shall now shortly indicate the most important steps in the calculation. First, we must remember that in every case we have two constants, the one being $E\,D$, which we will call δ, and the other being $D\,F$, or half the image $\mathcal{Y}$, which are both determined by the construction of the lenses and the Wollaston prism. It will, of course, be understood that the diagram represents only one half of the straight

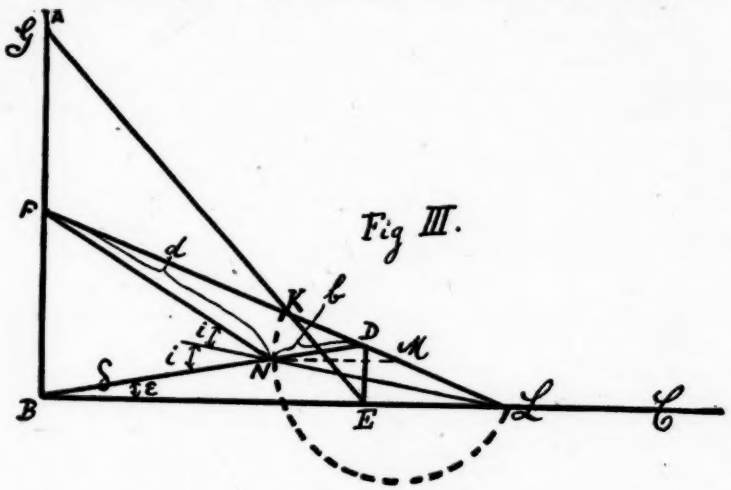

Fig III.

arm and of the image $\mathcal{Y}$, the remaining part being just the same on account of the equal but opposite movement of the mires of my own instrument. If one now proceeds to find under these circumstances the radius r, that belongs to a certain O, while $\mathcal{Y}$ and δ are always the same, one comes to very long and awkward formulæ, which will not be given here. It is, however, comparatively easy to find the radius r by construction, as follows:

Let, in Fig. III, $A\,B$ be the straight arm, $B\,C$ be the axis of the instrument, on which also lies the unknown centre of the cornea. Now, first construct from $B\,D = \delta$ and $\frac{\mathcal{Y}}{2} = D$

E, the right-angled triangle $B\,D\,E$. Let, further, $B\,F$ be the object $\frac{O}{2}$, the image of which shall be $\frac{\mathcal{Y}}{2}$, or $D\,E$. Now, make $F\,G = F\,B = \frac{O}{2}$ and draw $F\,D$, which may intersect $B\,C$ in L. Draw then $E\,G$, and call K the point of intersection with $F\,L$. Now bisect $K\,L$ and let M be the point thus found. Draw a circle from M with $K\,M$ as radius, and let this circle intersect line $B\,D$ or δ in N. Finally draw $F\,N$ and $N\,L$. *Then $N\,L$ is the radius of the cornea,* which latter will reflect ray $F\,N$ from the cornea into the telescope. The demonstration that this construction gives accurately $\frac{1}{N\,D} = \frac{1}{F\,N} + \frac{2\,\cos i}{N\,L}$, or $\frac{1}{\delta} = \frac{1}{d} + \frac{2\cos i}{r}$, and that $\frac{O}{\mathcal{Y}} = \frac{d}{\delta}$ would be too long, but can be easily supplied, if it is considered that $F\,L$ is harmonically divided. To find, now, r numerically, the following calculations must be made (Fig. III.):

(1.) $\sin \varepsilon = \frac{\mathcal{Y}}{2\delta}$ (2.) $\operatorname{tang} F\,L\,B = \frac{O-\mathcal{Y}}{2\delta\cos\varepsilon}$

(3.) $F\,D = \frac{O-\mathcal{Y}}{2\sin F\,L\,B}$ (4.) $K\,D = \frac{\mathcal{Y}\,F\,D}{O+\mathcal{Y}}$

(5.) $D\,L = \frac{\mathcal{Y}}{2\sin F\,L\,B}$ (6.) $N\,M = \frac{K\,D + D\,L}{2}$

(7.) $D\,M = \frac{D\,L - K\,D}{2}$ (8.) $\sin D\,N\,M = \frac{D\,M\sin(F\,L\,B+\varepsilon)}{N\,M}$

(9.) $\sphericalangle\ D\,M\,N = \sphericalangle\ F\,L\,B + \varepsilon - D\,N\,M.$

(10.) $\frac{r}{2} = N\,M\,\cos\frac{D\,M\,N}{2}.$

Thus for each O the corresponding r was calculated for my own instrument (a Javal of the old model), in which there was found $\delta = 342$ *mm*, and $\frac{\mathcal{Y}}{2} = 1.46$ *mm*.

The following table gives the result of this calculation:

Size of object O.	Difference in O for succeeding dioptries.	Dioptries of cornea.	Radius r of cornea.
221.66 *mm*	.....	36 *D*	9.34 *mm*
238.32 *mm*	6.66 *mm*	37 *D*	9.09 *mm*
235.02 *mm*	6.70 *mm*	38 *D*	8.85 *mm*
241.76 *mm*	6.74 *mm*	39 *D*	8.62 *mm*
248.54 *mm*	6.78 *mm*	40 *D*	8.41 *mm*
255.37 *mm*	6.83 *mm*	41 *D*	8.20 *mm*
262.25 *mm*	6.88 *mm*	42 *D*	8.01 *mm*
269.18 *mm*	6.93 *mm*	43 *D*	7.82 *mm*
276.16 *mm*	6.98 *mm*	44 *D*	7.64 *mm*
283.20 *mm*	7.04 *mm*	45 *D*	7.47 *mm*
290.30 *mm*	7.10 *mm*	46 *D*	7.31 *mm*
297.46 *mm*	7.16 *mm*	47 *D*	7.16 *mm*
304.68 *mm*	7.22 *mm*	48 *D*	7.01 *mm*
311.96 *mm*	7.28 *mm*	49 *D*	6.86 *mm*
319.30 *mm*	7.34 *mm*	50 *D*	6.73 *mm*
326.71 *mm*	7.41 *mm*	51 *D*	6.62 *mm*

This means, then, that for a distance in a straight line of 276.16 *mm* between the inner edges of the two mires, the corresponding radius would be 7.64 *mm*, whilst the corneal image would measure 2.92 *mm*. This would show a refractive power of the cornea of 44 D. For 45 D the distance would have to be 283.20 *mm*, or 7.04 *mm* more than before. Now if both mires move equally in opposite direction, it is evident that each mire will move only through 3.5 *mm* to indicate one dioptry. If one, therefore, graduates the straight arm itself, one cannot read off as well, the spaces between two succeeding dioptries being only one half the size they were, when only one mire moved. To obviate this difficulty, and to make the reading as easy as before, I added a second graduated bar below the straight arm. This bar is fastened to one mire and slides in a little case below the second, where the dioptries are read off. In this way the new scale moves twice as quick as each mire, *i. e.*, with reference to the second mire, thus giving again 7 *mm* space from 44 to 45 D.

I further discarded the stepped mire altogether, because now these steps would be quite inaccurate, and besides it is always more accurate to produce contact in each meridian. I replaced the mires by two yellow squares of exactly the same size. The yellow color was chosen because the blue rays, that interfere most with the exact contact, are then quenched to a great extent; and the mires were made of the same size in order to enable us to measure the angle α. For this purpose the straight arm has been divided into degrees, and has also been provided with little sights that move along it. After finding one main meridian, the patient is told to look at one of the two sights, and this is moved until the two adjacent images of the two mires are of exactly the same size, because then the corneal apex lies on the axis of the instrument. Now the angle α can be read off directly and then the corneal astigmatism be determined.

In conclusion, I must say that the straight arm with the new calculation on the lower movable bar, the two movable yellow mires of the same size, and the division into degrees for the angle α, are, in my opinion, a decided improvement upon Javal's instrument as far as an accurate measure of the

cornea is concerned. But of course I do not claim to thereby come much nearer to the cylinder to be prescribed; for this cylinder depends also upon the remaining astigmatism of the dioptric apparatus, on the axial ametropia, and the position of the glass in front of the eye, as has been explained before in these ARCHIVES, in the January number of 1893.

HOW JAVAL'S KERATOMETER MAY BE EASILY CHANGED INTO A GOOD CHROMATOMETER FOR THE EXAMINATION OF PATIENTS AS TO COLOR-BLINDNESS.

By CARL WEILAND, M.D.,

CHIEF CLINICAL ASSISTANT IN THE EYE DEPARTMENT OF JEFFERSON MEDICAL COLLEGE HOSPITAL OF PHILADELPHIA.

FOR the examination of patients as to color-blindness, certainly the most convenient and practical tests are those that make use of colored worsteds, like Holmgren's or Dr. W. Thomson's test, and others. There is, however, one disadvantage connected with worsteds, namely, that they are all more or less apt to change in color, not only by handling but also by light, dust, and other circumstances. Many attempts have therefore been made to find a substitute for these wool skeins. The spectral colors, though theoretically the best, cannot be well employed in an office in spite of Hirschberg's double spectroscope and the excellent apparatus of Captain Abney. For these reasons another method has been employed which also gives unchangeable colors, though these are not the simple colors of the spectrum, but color mixtures like those of the worsteds. These colors are produced by allowing polarized light to pass through a quartz-plate and again through a Nicol's prism. *Rose* was the first to make use of this method in his *Color-Measurer*, which he described in *Virch. Arch.*, xxviii., p. 30 *et seq.* He causes the light to pass through a Nicol's prism first, and then by a diaphragm through a double refracting prism, from where it enters first a quartz-plate, cut at right angles to its optic axis, and finally a second Nicol. He thus produces two circles of complementary colors, that change continually when the upper quartz and Nicol are rotated, but

always remain complementary to each other. The second instrument of this type was brought forward by *König* in his *Ophthalmo-Leukoscope* in 1884. It is like Rose's instrument, only differing in so far that the first Nicol is wanting, and that he uses quartz-plates of different thickness—5, 10, or 15 *mm* thick, according to the degree of saturation that the colors shall attain. The latest instrument of this kind is *Chibret's Chromatophotoptometer* of 1885. He uses, however, a quartz-plate that is cut *parallel* to its optic axis and obtains the change in colors by inclining the plate at different angles to the line of vision. These instruments have all their special advantages, but they are very expensive, and those of Rose and Chibret, in their present form, have that disadvantage that the color-fields are very small and must be looked at with about 4 D of accommodation. It occurred, however, to the writer to make use of Javal's keratometer, as this instrument contains already a very fine double refracting prism, and gives a considerable magnification. He got up a little contrivance of his own two years ago, which has worked so well since, that he thought himself justified in making it known to the profession, and in thus increasing the usefulness of Javal's instrument. His method differs from that of the authors mentioned above, though the principle is the same.

This color-attachment to Javal's keratometer consists of a straight metal tube, about 1½ inches in diameter, that reaches from the place where the patient's cornea usually is to about the beginning of the barrel of the telescope, and is so fastened to the head-rest that its axis coincides with the axis of the instrument. At the front part of this color tube there is a plane glass plate behind which a Nicol's prism is fastened in a cork. From this prism the polarized light passes by a round diaphragm through a quartz-plate, cut at right angles to its axis and about 5 *mm* thick.

This is essentially the whole outfit; for in looking with the Javal through this tube one will see two fine large color-fields partially overlapping each other. These color-fields are of complementary hues while the place of overlapping shows white; provided of course that white light as reflected

from a white surface, like a piece of white paper, is employed in this experiment. If now the arc of Javal be rotated, while the color tube remains in the same position, the colors will change continually but always remain complementary, returning however to their original hues after the arc has been rotated through 90°.

I would recommend the instrument to be used in the following way: Place your patient's eye at the ocular of the instrument after you first have looked in yourself and given to the new color-tube such a position that blue and yellow appear, because thus most color-blind people will recognize two different colors. Now ask your patient whether the two colors are exactly alike or at least shades of the same color. If he answers *No*, turn the barrel of your Javal slowly through 90°, telling your patient to stop you as soon as the two colors are the same. If he has good color-sense he will always see two different colors, but if he is color-blind he will find that in a certain position of the arc the two colors appear alike or at least as much alike as if they were shades of the same color. These colors will usually be green and rose for a green-blind person, while the red-blind person generally selects a more bluish green and a rose with much more red in it.

This suffices to prove that your case is color-blind. But if you want to go further, if you wish that the two colors shall appear *exactly alike* even in brightness (what can never be obtained with worsteds), then take a second Nicol's prism and fasten it so in front of the eye-piece that it can be rotated and is as near as possible to it. If now your color-blind patient looks again, leaving your arc of Javal as before where the colors appeared almost the same, you will, on rotating your new Nicol, easily find a position where the two colors look exactly alike, in hue as well as in brightness. Now put down in your case-book the position of your color-tube, that of the arc of Javal and that of the second Nicol, and you will always be able to reproduce the same color equation, even after years, when the wools would long have faded. The whole procedure for both eyes need not take more than a few minutes and is therefore quite convenient.

One might argue that this test would not always work well, because it depended altogether on the faithfulness of the examinee, and a color-blind person might simply refuse an equation between two complementary colors. This objection has been raised even by *Mauthner* in the new edition of his *Farbenlehre*, 1894, p. 127. But it will not be difficult to catch such an individual by putting without his knowledge a piece of red glass in front of the color-tube, so that only red rays will enter the instrument. Under such conditions the two discs must appear alike to him in a certain position of the arc, so that he will be induced more easily to admit the equality of the color fields, when the red glass is taken away and replaced by common plane glass. But should he refuse to see two equal colors even with the red glass, then he would betray his attempt to deceive and be caught by his very denial.

In the construction of this color-tube a quartz-plate of 5 *mm* thickness was used, but it would be well to arrange the tube so that one or two 5 *mm* plates more might be dropped in, because then the colors are much less brilliant and saturated, and therefore on account of their whiteness better enabled to catch even the slightest cases of color-blindness. But in the writer's own experience the 5 *mm* plate has been always sufficient.

The advantages of such a method for those who possess a Javal and therefore have to spend only a few dollars for the color-tube, are the following:

1. The colors will never fade or change in any other way as long as white light is used for the test.

2. One need not cover one eye, as only one eye can see at a time.

3. The color-fields are large, and it requires no accommodative effort to view them.

4. It is possible to make the two different colors appear exactly alike, while in the worsteds one must be content with an approximation.[1]

[1] Queen & Co. of Philadelphia will furnish these color-attachments.

A CASE ILLUSTRATING THE BAD EFFECTS WHICH THE ESTABLISHMENT OF MENSTRUATION MAY HAVE UPON THE COURSE OF INTERSTITIAL KERATITIS.

By JOHN DUNN, M.D., Richmond, Va.

ON February 20, 1895, I was consulted by Mrs. M., in regard to the condition of her daughter's eyes. Such examination as could be made in the presence of the most marked photophobia I have as yet met with revealed double interstitial keratitis, of an exceptionally severe type. It had existed in the right eye four weeks, and in the left eye one week, when I first saw the patient. Miss M's facial appearance and notched teeth told the cause of the trouble. Mrs. M. remarked that, although her daughter was fourteen years of age, menstruation had not as yet been established. Miss M. was put upon the usual constitutional and local treatment. Her general condition rapidly improved, as was shown by her gaining much in weight. Improvement in the condition of the eyes was slow, but gradual. The photophobia, however, remained intense; so much so that on March 18th Miss M. was obliged, for comfort's sake, in the presence of either gas or daylight, to tie over her dark glasses a silk handkerchief folded several times. She went to bed the evening of March 18th, with her eyes showing this degree of photophobia. *When she awoke on March 19th the photophobia had entirely disappeared and with it practically all evidences of active inflammation of the corneæ. Menstruation had become established during the night.* As Miss M. lived in a distant city it was about a week after the dis-

appearance of the photophobia before she was brought to my office. The condition of the eyes was then as follows: There were no traces of photophobia; indeed, the eyes could bear a light which would have been uncomfortable to a normal eye. There was, O. D., no redness of the conjunctiva along the corneal margin. The damage done to both corneæ, however, by the establishment of menstruation was beyond the hope of repair. Both corneæ were more or less cloudy; the left being more so than the right. Examined under a + 20 D sph. lens, the right cornea could be seen to contain numerous enlarged lymph channels and blood-vessels, the general direction of which was from periphery towards the centre (a condition Hirschberg and others have carefully described).

These lymph channels varied much in size and manner of distribution, some portions of the cornea showing large numbers of them, while others showed fewer. The left cornea was so milky (this milky appearance being in places in patches, as it were) that the normal corneal transparency no longer existed and the transmitted light was so little in amount that a strong plus lens failed to reveal the existence of the lymph channels so numerous in the right cornea. Vision: O. S., perception of light and existence of objects held between eye and light. All signs of active inflammation of the right eye had disappeared; not the slightest photophobia. The left eye still showed slight evidences of pericorneal irritation, but no photophobia. The establishment of the menstrual flow had, then, caused the interstitial corneal inflammation to cease abruptly, leaving the corneæ in the impaired condition to which the keratitis had brought them, and at the same time had removed the necessity for continuance of the inflammation until the corneæ had regained their normal transparency. The lymph channels seen in the left eye so plainly will in all likelihood remain visible under a strong plus lens as long as the patient lives, while there is little hope that the left eye can ever regain accurate vision. Time will modify somewhat the condition of the corneæ, but the changes now present must be considered as though they were of the nature of scar tissue, and time will

modify them only as it does scar tissue non-specific in its origin. The character of the inflammation which renders possible the formation of these abnormal lymph channels in the corneal tissue and later their gradual diminution to final disappearance is different from any which we can induce by artificial means in a healthy eye; hence arises the difficulty of obtaining by treatment results such as we desire. A further lesson seems to be taught by the above case. In cases of interstitial keratitis it should be our object to use only such treatment as will improve the patient's general health; we should avoid any treatment having for its object the abrupt lessening of the duration of the inflammatory processes when once they have become fully established.

On June 20th, three months after the disappearance of the signs of active inflammation, the condition of the corneæ is as follows: There has been a slight clearing of the cornea, O. D.; the dilated lymph channels are, however, all through the corneal substance plainly visible under a + 16 D sph. lens. In O. S., the clearing up of cornea has been more marked, and this has resulted from the partial disappearance of the flaky opacities seen immediately after the disappearance of the photophobia. In this eye now, also, the dilated lymph vessels are visible in large numbers. The treatment during this time has been constitutional; frequent hot baths for the eyes. Electricity has been applied to the corneæ twice a week.

A CASE OF DERMOID CYST OF THE ORBIT.[1]

By B. L. MILLIKIN, M.D.,

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DERMOID cysts of the orbit, while not excessively rare, are sufficiently so to make a clinical report of each case interesting and important.

In 1880 Berlin (Gräfe and Sämisch, *Handbuch der gesammten Augenheilkunde*, vol. vi., p. 678) reported all the cases he could find at that time, amounting to seventy-three, of which twenty-three were doubtful genuine dermoid cysts. In looking up the literature since that time very few cases seem to be reported. The text-books on ophthalmology, with very few exceptions, give no extensive discussion upon this disease. One of the best articles I find upon the subject is by De Wecker and Landolt (*Traité Complet d'Ophtalmologie*, vol. iv., 1889, p. 821 *et seq.*), to which the reader is referred for an extensive discussion on the subject.

Berry, in his *Diseases of the Eye*, speaks of a single case having been operated upon in the Edinburgh Royal Infirmary, in 1867, but that he himself has not met with a case.

I find the following among the cases which have been reported since Berlin's article in 1880.

Hirschberg (*C. f. A.*, Band vii., p. 295) reports having removed a congenital lipomatous dermoid cyst in and behind the equatorial region of the eyeball.

Nicaise (*France Méd.*, No. 31) reports the removal of a dermoid cyst.

Dr. L. Webster Fox (*Med. News*, vol. xliv., 1884, p. 749)

[1] Read before the Society of Medical Sciences, Cleveland, June 17, 1895.

has reported four cases of cystic tumors, superficial in the tissues of the orbit, cured by incision and cauterization of the sac walls with silver nitrate.

J. L. Thompson (ARCH. OF OPHTH., vol. xii., 1883, p. 183) reports a cyst of considerable size, containing dark fluid, cured by electrolysis. It is very doubtful if this is a genuine dermoid.

Vignes (*Rec. d'Opht.*, Par., 1891, 3, 5, xiii., 409, 412) has reported a dermoid cyst at the internal portion of the orbit.

Licharewsky (*Wjestnik Ophth.*, 1887, No. 2, p. 129) removed a cyst the size of a pigeon's egg from the upper, outer portion of the orbit, with preservation of the globe.

Krönlein (*Beiträge zur klin. Chir.*, vol. iv., 1) reports the removal of a dermoid with two cysts, connecting through a fissure in the outer bony wall of the orbit, one cyst being in the orbit, and the other in the temporal fossa.

Polaillon (*Rec. d'Opht.*, June, 1886) reports a case of the left internal orbital region.

Dunn (*Am. Jour. of Ophth.*, vol. i., p. 39) has reported an interesting case of a girl of sixteen, with dermoid tumor, beginning at the inner angle of the eye, apparently above the lachrymal sac.

Pooley (*Ophth. Record*, vol. i., 1891, p. 181) removed a dermoid tumor by a long incision extending from the outer to the inner angle of the orbit, allowing the wound to heal by granulation, this being the second operation on this case.

Cornwell (ARCH. OF OPHTH., vol. xi., p. 338) has reported an interesting clinical case, likewise healing by granulation after a second operation.

J. Mitvalsky (ARCH. OF OPHTH., vol. xxii., 1892, p. 378) presents an extensive microscopical study of the subject of dermoid tumors, in and about the orbital region, in which he refers to four cases by other operators, and two cases which came under his own observation. The paper is based upon the study of fourteen cases of orbital and peri-orbital tumors, and the reader is referred to this article for a most exhaustive report upon the study of these growths.

Since 1892 I have found no cases reported in the literature at my command.

In these notes I have simply given orbital or intra-orbital cases, not referring to the numerous cases where the tumor is upon the orbital margin or in the peri-orbital region. All of these cases have been intra-orbital.

The position of predilection, according to Berlin, was found to be in 53 per cent. upon the nasal side of the orbit, while 24 per cent. were upon the outer portion. In 15 per cent. the situation is directly below and 4 per cent. directly above. In the cases reported since, the position has been in the majority of cases outside of the centre. My own case is, primarily, undoubtedly, in the latter location, that is outside of the median line of the orbit.

CASE.—Frank R., æt. twenty-one, Bohemian, a large, muscular man, almost an athlete in build, came to my office on June 14, 1894, with the following history. Since thirteen or fourteen years of age he had noticed over the left eye an enlargement, which increased pretty rapidly until seventeen years of age. Since that time he does not think the size of the tumor has greatly augmented. At twelve years of age he remembers having been struck with a stone, somewhere above the eye, but does not remember just how long afterward the tumor of the eye began to develop, and from the subsequent history of the case the probabilities are that the blow had nothing to do with its development.

On examination I found the following condition present: O D v = $\frac{6}{6}$, O S v = $\frac{6}{6}$. The right eye is perfectly normal in every respect. Interior of both eyes normal. In the superior portion of the left orbital region there is a marked bulging of the tissues, protruding beyond the line of the orbital ridge, extending from the outer to the inner angle, slightly more marked within the median line. The eyeball is pushed forward, downward, and outward. The movements of the eyeball are apparently not restricted, and at no time has he noticed double vision. The upper eyelid droops slightly. Under the finger there is a large mass, quite hard in consistence, filling up the entire orbital space above the eyeball, apparently in the region of the lachrymal gland, and extending on either side to the angle of the orbit.

At the time I was inclined to believe the tumor to be connected with the lachrymal gland, but a positive diagnosis was not made. Removal of the growth was advised. This was inconvenient for the patient at the time, so its removal was postponed. No pain

had ever been present, and no discomfort from the growth had ever been experienced by the patient, other than its cosmetic effect.

On Feb. 11, 1895, I again saw the patient. The condition at this time presented no appreciable variation, and apparently the size had not increased during the interval.

On Feb. 14, 1895, the patient being etherized, the following operation was performed: A long incision extending from the outer to the inner angle of the orbit, in a circular line, following the lower border of the eyebrow was made. Careful dissection was made through the skin and fascia down upon the tumor just at the upper margin of the orbit. The attempt was made to follow as close along the orbit as possible, in order to produce the least amount of disturbance of the tissues connected with the eyeball.

Upon reaching the tumor it was found that the contents were fluid, and the walls excessively thin and somewhat transparent. In endeavoring to dissect out the tumor, it was found impossible to remove it without rupture on account of the extreme thinness of the cyst wall. Rupture took place, and the contents escaped. This consisted of an albuminous-like fluid, probably more than half an ounce in amount, filled with apparently epithelial *débris*, and about the consistence of the white of egg. There was then complete collapse of the cyst and of course no certain dissection of the entire walls could be made. The cyst had extended entirely across the vault of the orbit, and deep down, almost to its apex. Just outside of the median line and close to the vault of the orbit, about the middle portion, antero-posteriorly, was found a large collection of hairs and epithelial *débris*. The hairs were many of them nearly an inch in length and brown in color, a shade or two lighter than the hair of the patient's head. Several forceps full of these hairs were extracted from this deep portion. Upon investigating in the same region with the finger I found a sharp spur of bone projecting from the vault into the cavity of the orbit, perhaps one quarter of an inch in length. The bony spur was about the size of an ordinary eye tooth. This seemed to have been the centre about which the growth had developed, as here the solid portions of the contents of the tumor were located. The walls of the cyst after rupture were deep red, or almost purplish in color, showing a high state of vascularity. As extensively as could be done the cyst wall was

dissected away, the contents entirely cleared, and the tissues, where doubtful, were irritated thoroughly by raking with a burr. It was hoped that by thus raking the cyst wall inflammatory action might be developed sufficient to destroy it, and to permit it to become adherent to the neighboring tissues, without a tendency to redevelop.

In a growth so extensive, and with walls so thin, it was simply out of the question to dissect the cyst wall out in its entirety.

Thorough asepsis was carried out in all the steps of the operation, and the cavity left after the removal of the tumor was carefully washed out with a bichloride solution, 1 to 5000. The edges of the wound were then carefully approximated, and sutures introduced to hold them in the proper position. No drainage tube was employed.

There was profuse hemorrhage from the cyst and its walls during the different steps of the operation, but no vessels required to be tied. Hemostatics were used freely to staunch as much as possible the flow of blood. Oil protective and iodoform gauze were placed over the line of the incision, a gauze compress was made to press firmly the eyeball back into the orbital cavity, and all was kept in place by a firm roller bandage. The patient was put to bed and kept quiet for twenty-four hours. The next day he complained of the frontal portion of his head being "dead," evidently the supra-orbital nerve having been divided in the operation.

The wound healed perfectly by first intention, and the bandage and compress were removed on the fifth day, nothing being placed over it but a bit of adhesive plaster. The stitches were all removed on the sixth day, and the wound found to be entirely healed. At first there was difficulty in raising the eyelid, and there was great lack of feeling over the left frontal portion of the head. The eyeball was in good position, and its movements were entirely normal. There had been no affection whatever of his vision, in fact the sharpness of his vision had increased by the 7th of March, three weeks after the operation, and was at that time $\frac{4}{5}$. The only disturbance of the eyeball was a slight subconjunctival chemosis at the outer angle. Since the operation there has been a gradual improvement in the ability to raise the lid. When last seen he was able to open the eyelid fully one half.

There existed a peculiar and interesting condition of the bones

about the orbit quite worth noting. The edge of the orbit above was very much thickened all along the upper margin, rounded, and with no sharp angle as in the opposite eye. This extended from the outer to the inner angle, and affects quite materially the entire shape of the orbit. The floor of the orbit in front seems to be somewhat depressed. This is interesting as showing the effect upon the development of the bones from the pressure upon them of the orbital growth. Other than a slight drooping of the lid there is now no disturbance, and the scar is simply a linear one following the line of the brow and scarcely detectable. Thus far there has been no indication of any return of the growth, but it is too soon to definitely decide so important a question.

I find that in many of the cases in which recurrence has taken place this has been noticed within a comparatively short period after the first operation. Many of the cases reported have suppurated, and of course the process of healing has been a very different one from that of primary intention. In not a few the eyeball, or vision, has been sacrificed.

The treatment of all cases of dermoid cysts should be operative. Whether or not an attempt at removal is the wisest course to pursue, must be determined by the nature of the growth itself in each individual case. If the diagnosis were positive, and if we were certain that no hair or other extraneous material were present, there could be no objection to the method of aspiration and injection with an irritating fluid, such as iodine, etc. Otherwise, undoubtedly, the best course is removal.

In small tumors with thick walls the removal of the entire cyst with its walls would not be particularly difficult, but with large tumors, with thin walls, the complete removal of the cyst with its walls I believe to be impossible, even in the most skilful hands. Under such circumstances the dissection of as much of the cyst wall as can be removed, and the thorough irritation of the rest by scraping or scarifying, would develop sufficient inflammation to produce adhesions of its sides and obliteration without suppuration. If union by first intention can be secured, the advantage of it must

be apparent to every one. Not infrequently abscesses are the result of injections; they frequently produce very severe reaction and may be painful to the patient.

I cannot but believe that removal, as complete as possible, should be attempted in the vast majority of cases, as being a better surgical principle for the treatment of these conditions than any other.

TRAUMATIC PARALYSIS OF THE ABDUCENS NERVE.

By H. MOULTON, M.D., Ft. Smith, Ark.

THE two cases of traumatic paralysis of the abducens nerve reported by Zimmerman in these ARCHIVES, vol. xxiv., No. 2, with those previously reported by Purtscher and by Friedenwald, when added to the following case from my practice, constitute a round number of sixty cases recorded so far.

On May 20, 1894, a boy, aged eleven years, fell from a bicycle on to a brick pavement. Immediately afterwards a carriage wheel passed over the boy's head, the left side of the head being next to the pavement, the right side receiving the weight of the wheel. Thus the head was crushed by a directly transverse force, and I am told that it was perceptibly flattened. Blood escaped from both ears and nostrils. Consciousness was completely lost for ten days, gradually returning after that time. On the recovery of intelligence the patient complained of double vision. It was noticed that he was deaf on the right side, and that the right side of the face was immobile, and that the right eyelids had lost the power of voluntarily closing.

The case was brought to me on July 12th, when I saw it for the first time. There was complete paralysis of the right auditory nerve and of the right facial nerve. The diplopia was manifest when the patient looked straight in front, and increased on looking to the right. For the median position single vision was obtained with an 8° prism. Acuteness of vision and refraction were normal. There were no ophthalmoscopic signs. Intelligence and the general bodily functions were good. No visible marks

of fracture were discoverable in any of the cranial bones. Six months after the first visit of the patient, the abducens had so far recovered that diplopia was only manifest on looking about 15° to the right; and at the present time, one year after the first visit, it is only manifest on looking *extremely* to the right. The facial paralysis has almost completely disappeared, but the acoustic paralysis remains complete.

This case was probably primary, though the abducens paralysis was not observed during unconsciousness, the symptom not being then looked for. From the direction of the force and the associated paralyses, the paralysis of the abducens, together with that of the other nerves involved, was probably produced by a longitudinal fracture of the petrous portion of the temporal bone.

DIPLOPIA OCCURRING AT THE PERIPHERY OF THE FIELD OF FIXATION.

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(*With 3 figures.*)

A PAPER, by Dr. A. Duane, read before the section of Ophthalmology, N. Y. Academy of Medicine, and published in the ARCHIVES OF OPHTHALMOLOGY, vol. xxiii., Nos. 1–2, entitled "Paralysis of the Superior Rectus," has suggested the advisability of studying the subject of the diplopia which is known to occur in *normal* eyes at the limit of the field of fixation, since his diagnosis of this affection, which he alone has found so common, is based upon diplopia in this portion of the field. The method pursued will be, first, to consider the reasons why diplopia appears; secondly, to study the behavior of the double images; and finally, to show its occurrence in practice and how the results compare with the observations of Dr. Duane.

1.—*The Cause of the Diplopia.*

For the purpose of carrying out the following experiment we adjust the head, rendered immovable by some device, in the primary position, in the centre of the arc of a large perimeter, so that the line joining the centres of rotation of the eyes is coincident with the cross diameter of the perimeter, and their middle points the same as shown in Fig. 1, where *R* and *L* represent the centres of rotation for each eye respectively and *o d o' e* the arc of the perimeter. We then observe the greatest possible angle through which each eye can

turn and still see clearly a small letter fixed on the slide. In this way we map out on the usual chart the limit of the excursion of each line of vision—that is, the field of monocular fixation, *r r* and *l l*, Fig. 2. It is evident, however, that the true angular deviation is not obtained in this experiment, since by the modification of the usual arrangement each eye lies, not in the centre of the arc of the perimeter but is removed one half the distance between the centres of rotation (30–35 *mm*).

Further, in most portions of the field of fixation it is possible to see the object, although indistinctly, if it is moved

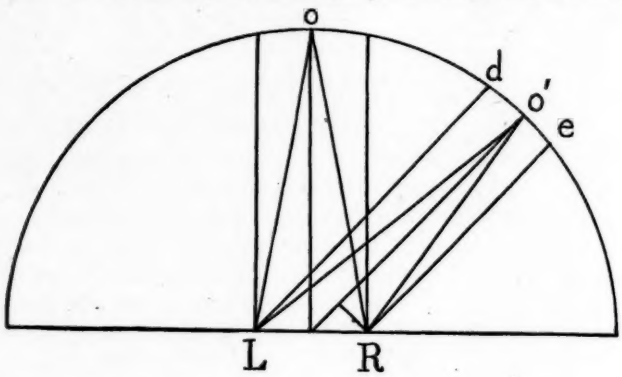

Fig. 1

beyond the field of fixation, and there can be traced, beyond its limit, a field of vision *R R* and *L L*, the boundaries of which are formed by the intervention of the brow, nose, and cheek on the upper, inner, and lower sides. The two fields for each eye in my own case are shown in Fig. 2, obtained by means of after-images of a bright light at the macula, which follow exactly the motion of the line of vision. It will be seen that beyond the point 45° to the right side, the line of vision of the left eye cannot turn and the limit for the right eye is 55°. As an object passes beyond the limit of motion for the left eye its image will fall outside the

macula although the right eye can still fix upon it, hence it is obvious that *diplopia* must occur and that *crossed.* There are three conditions under which diplopia might not occur at the near point in this part of the field. Either the internus might exceed the externus in power by enough to equal the difference as shown (about 10°), or the nose must cut off the field on the inner side before the limit of fixation is

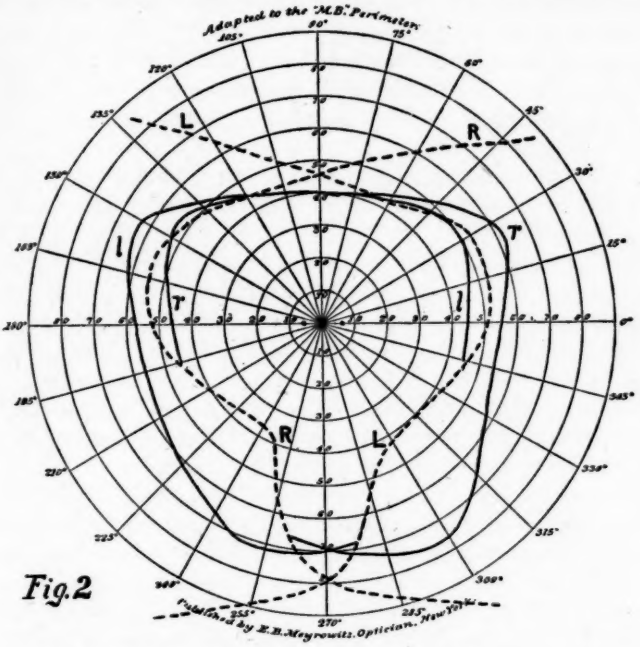

Fig. 2

reached, or there must be an additional stimulus to the internus accompanying the effort at convergence.

1. In regard to the comparative extent of motion for each eye Helmholtz gives 50° as the greatest possible extent of motion, both inwards and outwards. This is about the case in my own eyes, outward motion, however, being a little stronger (2°) than inward, which is contrary to the rule, for, according to the average of eight authorities given by Hering, the inward excursion of each eye is 45°—the out-

ward 42°. In normal eyes examined by me I found the angular deviation nearly equal for inward and outward motion with a difference of not more than 4°.

2. In reference to the intervention of the nose it is seen in Fig. 2 that in my own case there is a space of about 6° where diplopia must occur at the near point. As one would suppose, this space varies in individual cases, but out of 14 cases examined in reference to its existence I found only one case in which the line of vision could follow an object in the motion inwards until it was cut off by the bridge of the nose. As determined on a perimeter of 30 *cm* radius, this space where unconquerable diplopia occurs, varies from 0° to 12°.

3. One would not suppose that, after the eye was turned inwards to its greatest extent in distant vision, still further adduction could be brought about by the effort of convergence, nor do we find that this is possible, indeed quite the contrary condition is asserted by Hering, namely, that the binocular field of fixation is less than the part which the two monocular fields have in common—that is, that the space enclosed by the lines *R*, *L*, *l*, *r*, Fig. 2, does not represent the binocular field of fixation. This was by no means true in the cases observed by me, but would account for diplopia irrespective of the conditions referred to above.

Another method of demonstrating the limit of motion for the eyes is, with the left eye closed and with the other fixed on a distant object lying a little above the horizontal plane, to turn the head on a vertical axis to the left away from the object with the eye still fixed upon it. As the eye reaches its limit of motion, the object of fixation and the whole field will seem to revolve in the opposite direction to the motion of the head. This happens also when the other eye is turned inwards, showing that the limit of motion is reached before the nose intervenes.

Having seen the causes for diplopia in extreme lateral motion, we pass to consider the field of fixation when the eyes are turned directly *upwards*. At this point it is necessary to state a fundamental principle which underlies the phenomena of the motility of the eye, namely, that being

commonly accustomed to regard objects which are near at hand in looking down, distant objects in looking up, we find convergence more difficult in the upper part of the field of fixation. This convergence, however, I find is generally possible in extreme upward motion, if the object is not too near the eyes. Thus uncontrollable diplopia does not necessarily occur above at the near point, except beyond the limits of the field of fixation when, according to the law of corresponding points on the retina, an object will appear double if it is outside the total horopter. Hence, as in this case, the horopter is a line inclined with its upper end toward the observer; a vertical line, if its lower end be fixed, will appear double with the two images divergent. This is difficult to observe. It can readily be seen in view of the difficulty, or in some cases impossibility, of fixation at the near point above, that divergence may easily occur. This is actually the case, and as a consequence lateral diplopia, obviously crossed, is of common occurrence in the upper field. At an infinite distance diplopia does not occur above, as a rule, because the lines of vision are parallel and seem to remain so when the object of fixation passes beyond the limits of the field, and because the horopter is then an infinitely distant perpendicular plane; either crossed or homonymous diplopia is possible, however, in individual cases, the tendency being toward the former.

In the *lower* part of the field of fixation diplopia is not found at the near point, but homonymous diplopia occurs in some cases at a distance, from the tendency to convergence below, in accordance with the principle enunciated above. In the few cases in which I have tried this, I get homonymous diplopia at a distance in some, but only at the extreme lower limit, although the tendency is always present. In others, and in my own case, the diplopia is conquerable even to the very limit of the field.

In the *upper lateral* parts of the field, according to the diagram, unconquerable diplopia does not occur. It must be observed, however, that by raising the eyebrows, as is usually done in extreme upward motion, the field of vision is considerably extended beyond the field of fixation, and under

those conditions I get unconquerable diplopia. Practically it is with difficulty that an object can be fixed at the near point, at the limit of this portion of the field, on account of the strain in maintaining convergence with upward and lateral deviation, and diplopia readily occurs, in many cases unconquerable.

In the *lower lateral* parts of the field diplopia cannot occur on account of the fact that the nose cuts off one eye.

It must be said in reference to the foregoing observations that variations in almost every particular occur in individuals whose muscular apparatus may be said to be normal; the experiments are in parts of the field rarely used and with the muscles under strain; further, the muscular power varies from day to day or even during the examination. Patients will also often make a momentary effort which they cannot sustain, in many of the tests. Finally slight variations in the laws of motion of the eye are known to occur at the extreme periphery of the field.

2.—*The Behavior of the Diplopia.*

If, with the head fixed and the eyes directed upwards and to one side, to a point on the opposite wall, we bring a pencil with its point at a distance of 30 *cm*, in the plane of fixation (which is a plane determined by the centre of rotation of each eye and the fixation point), it will appear double, the diplopia being crossed. The point of the pencil in each image will be at the level of a horizontal line on the wall containing the fixation point, such as the cornice, and this experiment, repeated with the greatest care in reference to the primary position and immobility of the head, shows that the double images of an object at the near point formed during divergence in a given elevation of the plane of fixation occur in this plane of fixation and are projected on to the horizontal line in which this plane cuts the wall. If now we turn our attention to the relative heights of the two images, a fact appears to which I wish to call especial attention, namely, *the inner image seems the higher* Horizontal lines on the opposite wall we judge to be horizontal, hence it is

evident that the images are not referred to the plane of the wall. Each image is, in fact, localized in space at the distance of the real object and on a sphere at right angles to the line bisecting the angle made by the two lines of fixation, hence passing through the middle point of the imaginary line joining the centres of rotation (which point is the centre of the sphere) and through the fixation point. If we push a pin through a card so that it projects perpendicularly from the other side, then with the head level and the eyes in the oblique position (upwards and to the right) hold the card in such a way that with one closed the image of the pin is exactly in the line of vision

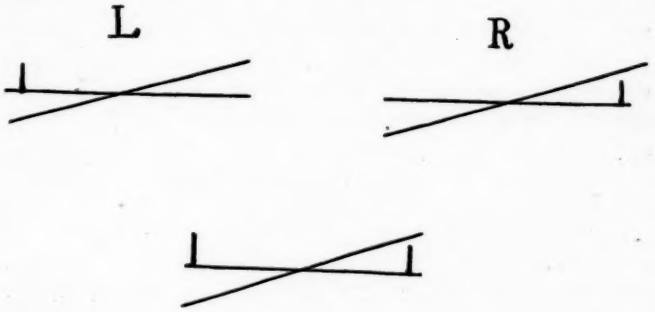

Fig. 3

of the other eye, and appears as a point, by rotating the card about the pin as an axis until its upper edge is coincident with a horizontal line on the wall, that is, until it lies in the raised plane of fixation, we have an inexact representation of the surface to which the double images are referred, and it is apparent from the evident inclination of the upper edge of the card, why double images in the plane of fixation seem at different levels in reference to the plane of the horizon. When the other eye is open the double images of the edge of the card in divergence are in the same straight line. Fig. 3 shows the formation of the images on the retina, as seen from behind, when the eyes are directed upward and

to the right. The oblique line represents the position of the retinal horizontal due to the wheel-rotation (Helmholtz) as shown by an after-image; the horizontal line shows the line in which the plane of fixation cuts the retina, and it is along this line that the double images always occur. The lower figure gives the two retinæ superimposed.

The vertical diplopia occurring as described increases with the deviation of the eyes from the median plane (where the images appear at the same level) and also with the elevation of the plane of fixation. The amount of vertical diplopia can be calculated from the formula given by Helmholtz for determining the wheel-rotation in a given position of the eyes.

In regard to the distance between the images, this will vary (1) with the amount of relaxation, being greatest when the lines of vision are parallel; also (2) with the distance of the object from the eye, and finally (3) by the drawing together with lateral motion of the parallel lines of vision, as shown in Fig. 1. The image belonging to the nearer eye appears the larger, the other is more distinctly seen because it is easier to accommodate for this.

In order to understand the tilting of the double images of a straight line or a candle, it is necessary to repeat the experiment of Meissner, by suspending a black thread in a vertical position before the eyes and by voluntary divergence, or if one has not learned to accomplish this, by fixing a point just behind the thread, causing the thread to appear double. The two images of the thread appear to *diverge* above, but by inclining the thread with its upper end away from the observer, in the median plane, at the proper angle, they will appear parallel—that is, will be in the horopteric line. The tilting is greatest when the two images are nearest together. This phenomenon is due to a rotation of the eye outward by convergence, which causes divergence of the apparent vertical meridians of the retina, and also to the divergence of the apparent vertical meridians, in parallel sight, due to an incongruity of the retinæ, which is normal in varying degrees. The divergence of the upper ends of the two images also takes place in the diplopia occurring in

extreme lateral motion. In looking upwards the images caused by slight divergence, as described above, in order to appear parallel must be inclined away from the perpendicular to the plane of fixation thus raised, but by no means as far as a vertical position. If however the thread is carried through a greater angle into a vertical position, then the double images seem to *converge* above, because now the upper end has passed to the other side of the horopteric line, and the same is true in lateral positions in the raised plane of fixation. Patients will rarely observe the tilting unless attention is called to it. The tilting as described above I have been able to confirm with more or less exactness in a number of cases examined with this point in view.

3.—*Occurrence in Practice.*

Having shown the causes for the existence of diplopia and the behavior of the double images, we turn to inquire whether it actually occurs in practice, and if so, what the patients tell us in reference to the images. We are at once confronted with a difficulty, in that the vast majority of individuals will not recognize double images even when the conditions which produce them are present. For instance, if a patient is told to gaze at a distant object, his finger held before the eyes will not ordinarily appear double, although almost every one can be taught to see the two images. Hence out of 56 individuals examined, during two months' time, for diplopia at the near point, 11 saw double at once in some portions of the periphery of the field; 7 in upward, lateral, and oblique positions; 3 in lateral and oblique, and 1 in lateral positions only. Out of 45 remaining, 41 saw double if attention was called to the two images when looking beyond the object, and diplopia of the character described above was always present at the periphery. Four could not be made to see double under any circumstances. The point of especial interest is that of the 52 cases who saw double, 49 said that in the oblique position the inner image seemed higher than the outer. In two cases they seemed at the same height, being probably referred to the plane of the wall. A

few declared that there was a difference in the vertical diplopia on the two sides. This was due either to a slight tilting of the head, which is involuntary and difficult to prevent in clinical observations, and at once affects the relative heights, or to the presence of hypophoria. Whether due to the former cause or not, it is easily determined by the fact that diplopia will not be present at a distance, whereas if hypophoria is present, and the variation is due to an actual difference in the elevation of the two lines of fixation while the centres of rotation are in a horizontal line then diplopia must occur for distance, at the periphery. Diplopia at a distance at the periphery of the field is of common occurrence, and, as would be expected, insufficiencies of the interni, as a rule, show crossed diplopia of the externi, homonymous. Vertical diplopia with or without lateral diplopia occurs above in many cases of hypophoria. Unconquerable diplopia I find to be more common above at the near point in insufficiencies of the interni. Dr. Duane in the paper referred to above, makes the statement (p. 74) that "the characteristic feature is contained in the expression Eu & r D L > > [which interpreted means: eyes up and right, vertical diplopia increasing with the outer image the lower], which alone is sufficient to make out the presence of this condition" paralysis of the right superior rectus, also stating that D X < < [crossed lateral diplopia, diminishing] is present. Now this is exactly the behavior of the diplopia which occurs in *normal* eyes spontaneously or by voluntary divergence, as I have attempted to show. Hence it does not seem necessary to infer "congenital paralysis of the superior rectus" in order to explain the phenomena which he has recorded in the fifteen cases appended to his paper.

A NEW METHOD OF TYING THE SUTURES IN ADVANCEMENT OF THE OCULAR MUSCLES.

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(*With four figures.*)

TO bring this before you I will describe in detail the advancement operation at present practised by me, although not claiming any portion of it as original except the manner of fastening and tying the sutures. This method is equally as serviceable in advancements for heterophoria as in true squint.

The first step in advancing the muscle in, for instance, convergent strabismus with a turning in of say 5 *mm*, would be a tenotomy of the internal rectus muscle.

FIG. 1.

Second step. Fastening sutures.—Thread a full curved needle with No. 3 iron-dyed silk, bringing ends of thread together and tying in a small hard knot, or both ends of the thread may be passed through the eye of the needle at the same time, leaving the end of the suture in the form of a loop instead of a knot. The needle is now passed through the conjunctiva, taking a good bite into the sclera close to the cornea, as indicated in drawing No. 1.

After the thread is pulled about half way through, the needle is passed through between the threads on the other side of its entrance into the sclera and then drawn home thus affording a firm point of fixation. A similar suture is fixed in the same manner upon the opposite side of the cornea.

Third step.—The belly of the muscle to be advanced is now picked up with a pair of mouse-tooth forceps through the conjunctiva; with a pair of scissors the conjunctiva is snipped through both above and below the muscle, at the same time freeing any submuscular attachments from the globe. A tenotomy hook is now passed underneath the muscle, and the conjunctiva and submuscular tissue cut horizontally towards the cornea and then towards the external canthus and the belly of the muscle thoroughly freed from the globe. (See drawing No. 2.)

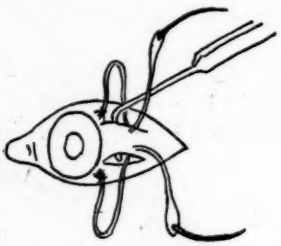

FIG. 2.

The sutures are now passed through the belly of the muscle from below upwards as far back as is believed necessary, and the sutures pulled about half way home. The muscle is still being held up with the tenotomy hook, and is now cut off just in front of the entrance of the sutures. The hook being of no further service, is supplanted by a pair of fixation forceps, with which the short piece of muscle attached to the globe is grasped and cleanly dissected from the globe. (See drawing No. 3. The portion of muscle removed is shaded.)

The sutures are now pulled home, and both grasped between thumb and finger, while the globe is fixed with forceps

on nasal side of cornea and turned outward, while the muscle is advanced to the desired position, or until the eye is in its proper position. I do not desire an over-effect.

FIG. 3.

Fourth step.—The sutures are now tied in a surgeon's knot over the muscle, as indicated in drawing No. 4.

The advantages of this suture over any other method I have tried are that, as the eye is drawn into position, both sutures can be controlled with one hand, leaving the other free to turn the globe in the desired direction with forceps. There is no rotation of the globe upon its anterior-posterior axis, as the tension upon each suture is the same, and this

FIG. 4.

equal tension is maintained throughout the time of healing. The sutures are easily removed by snipping the threads anywhere between their scleral and muscular attachments, grasping the knots with forceps and lifting them out. I find it is not necessary to leave them in longer than four days. The operation described can be performed under cocaine subconjunctivally injected. There is no deformity at the site of operation, and within a month's time it is difficult to see that an operation has been performed.

A CLINICAL STUDY OF ONE HUNDRED AND SIXTY-SEVEN CASES OF GLAUCOMA SIMPLEX.

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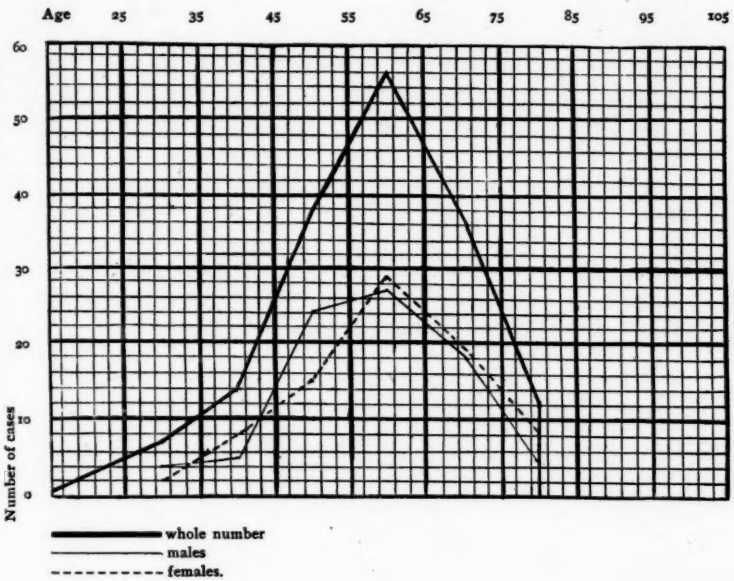
THESE cases were observed in the services of Doctors William F. Norris and Charles A. Oliver at the Wills Eye Hospital, Philadelphia. The authors wish to thank these gentlemen for permission to publish these findings, and to express their appreciation of the careful and thorough clinical methods which have made such a study possible, and which have added so much to the value of the article.

It has ever been the custom in these clinics to note the full description of each eye, including the ophthalmoscopic appearances, in every patient who was admitted to the clinic, so that the percentages which have been deduced from these findings must be more nearly accurate than those obtained in clinics where the practice has been to employ the ophthalmoscope only where it seemed particularly indicated. In view of the fact of the large number of patients who came complaining of affections of the external coats of the eye or of the adnexa, but in whom distinct glaucomatous symptoms were discovered, many incipient cases would have been overlooked had not the routine practice been rigidly adhered to in every instance.

The 167 cases occurred among 22,680 patients, or .736 %.

Men were found to be slightly more liable than women, 85 of the 167 cases occurring in males and but 82 in women.

Past middle life exhibited the best soil for the growth of the disease, although senility and extreme youth were not exempt. The extremes noted were 13 and 96 years. The next oldest cases, however, did not occur until between the ages of 75 and 85, the next youngest until between the ages of 25 and 35. But these extremes of age were exceptional,



and the disease showed a marked preference to occur between the ages of 55 and 65 years, although the average of the total number affected fell within the preceding decade, being 52½ years. Of the total number, 1 occurred at 13 years; 6 between 25 and 35 years (2 of these at the age of 26); 13 between 35 and 45; 39 between 45 and 55; 56 between 55 and 65; 37 between 65 and 75; 13 between 75 and 85; none between 85 and 95, and 1 at 96. In one instance the age was not given. These figures are quite in

harmony with the ocular changes which, occurring as a part of or complicating the disease, suggest its senile character. The accompanying table, arranged after the form of Priestly Smith's, shows very graphically the relationship existing between the age and the sex in the production of the disease. It becomes at once apparent that at the age of 50, males are much more prone to the disease than women. This is quite at variance with what one would expect, as the climacteric, by its interference with the general circulatory system, would naturally be supposed to offer favorable conditions to the development of glaucoma. Thinking that these figures might be misleading, owing to a possible predominance of male patients at the clinics, the authors made a careful count of the number of males and females which comprised the total number from which the cases were drawn, and they found that of 22,680 cases, 12,089 were females, whilst but 10,591 were males. This proves conclusively the greater liability of males, for, in spite of their smaller number, they were affected in a higher proportion. After the sixtieth year both sexes seem to be almost equally liable, females slightly more so than men.

The authors wish to call particular attention to the value of this table, for it represents statistics based upon observations which they deem to be more complete than any which have been hitherto made. Priestly Smith's table is founded upon the observation of one thousand cases collected from different sources without mention being made of the proportion which they represented of the total number of cases from which they were drawn, nor of the sexual composition of the clinics in which they occurred.

Much has been said from time to time in regard to *systemic diseases acting as predisposing agents to glaucoma.* The history of previous systemic disease which is elicited in an ophthalmological clinic is unfortunately too often but scanty and unsatisfactory. The intelligence of such patients is often at fault, but more often there seems to be a reluctance upon the part of the patient to depart for one moment from the recital of his ocular symptoms to recall a general disease from which he may have suffered years before, and which

to him bears no possible connection with his present local affliction. From the findings, however, it would appear that regard must be paid to two diseases in the production of this form of ocular disease—rheumatism and influenza. Whilst the influence of the latter was traced as a causal factor in but a small number of cases (7), nevertheless the relationship was so close in these that it must be given due importance. Influenza is a disease which has manifested itself with unusual severity during the past decade, and the authors are of the opinion that the increase in the frequency of glaucoma simplex, which was found to occur in the later years was due to the deleterious action of this affection. Twenty-one of the cases were subject to distinct attacks of rheumatism. When the age of the subjects is considered, and the exposure to which most of them as laborers of different kinds had been subjected, perhaps this proportion would not be higher than that found among those of the same age and in the same walks of life who exhibited no traces of glaucoma; nevertheless the proportion of cases in which rheumatism existed is large, and there seems to be good evidence to support the opinion that the arthritic variety of the disease especially predisposes towards the glaucomatous state. Typhoid fever was thought by the patients to have been a predisposing cause in 3 instances, and intermittent fever in 3, whilst dysentery, syphilis, epilepsy, dyspepsia, and the menopause were each held as accountable for the causation of the disease in 1 instance. All of these affections tend to lower the vitality, and it is probable that with the predisposition towards the disease already existing locally, it was precipitated by the impaired general condition which they wrought. At the same time with the ocular disease, in addition to the foregoing, which were supposed to have exerted a causative agency, there existed in a sufficient degree to have excited the comment of the patient cardiac disturbances in 5 cases, uterine disease in 2, and ozæna, apoplexy, and hemorrhoids in 1 instance. Fifteen claimed to be in good health, 9 were addicted to the use of tobacco, and 3 were intemperate in the use of alcohol.

Simple glaucoma being defined as a progressive affection

not usually associated with any inflammatory signs or subjective sensations, it is of great interest to note *the causes which led those suffering from it to a consultation for* their ocular affection. In our 167 cases, 39 sought treatment on account of failing sight, 19 on account of presbyopia, 19 on account of ocular pain, 5 on account of headache, and 3 on account of asthenopia; whilst the disease was accidentally discovered in a number of instances in individuals who sought relief from external affections, such as foreign bodies, catarrhal conjunctivitis, etc. As just stated, failing sight was the cause which most frequently led the patient to seek treatment.

Glaucoma is essentially a disease which is attended by loss in the visual acuity, but the absence of this symptom does not preclude the possibility of the glaucomatous process, for in 36 eyes in which there were other well marked symptoms of the disease, the central visual acuity was normal. It may be seen by this, and it is generally acknowledged, that *the degree of central visual acuity* is not a safe guide to the extent to which the glaucomatous process may have advanced, and when reliable information is desired of the visual condition recourse is usually had to a study of the peripheral vision as revealed by the perimeter.

Of the 167 cases, *failing sight was noted in both eyes* in 65 instances, whilst in 13 cases the defect was noted in but one eye. The disease is almost without exception binocular, and had these 13 cases delayed seeking advice somewhat longer they would undoubtedly have had to complain of loss of vision in both eyes. It was but rare that the sight of each eye became simultaneously affected, for it was found that after the loss of the visual acuity had first manifested itself in one, an average period of twenty months elapsed before it showed itself in the fellow eye. Even after the patient had become conscious of the fact that his sight had commenced to fail, the loss was so gradual and produced so little annoyance that it was found that an average of 3¼ years were permitted to elapse before it was deemed necessary to seek to improve it. The vision of the left eye was more affected in 66 instances, the right in 50, while both

eyes were affected in a similar degree in 40 cases. Although the patients' statements in regard to the time elapsing after the appearance of failing sight before total blindness ensued or vision was reduced to light perception, must be given a great deal of latitude, the average time necessary to accomplish this unfortunate result was 2 years 5½ months. The following figures are of interest as showing the different stages of the disease existing in the eyes at the same time.

a. In 36 instances both eyes possessed full visual acuity, $\frac{6}{6}$ or $\frac{6}{12}$.

b. In 6 instances one eye possessed full visual acuity, and the other was blind.

c. In 107 instances vision was reduced more than one half in both eyes.

d. In 62 instances the difference in visual acuity in both eyes was more than one half.

e. In 25 eyes vision was reduced to l. p., and in 14 it was totally abolished.

f. In 32 of the eyes with full visual acuity, there were distinct glaucomatous excavations.

After loss of sight *headache* was the most prominent symptom, 44 patients stating that they suffered from it. This symptom did not affect all similarly: 11 described it as being temporal in character, 14 as frontal, 7 as occipital, while in 3 instances it took the form of a hemicrania. Eight asserted positively that they had never had any pain in the head.

Ocular pain was present in 18 cases, whilst in 12 instances, where this symptom was suspected by the surgeon, the patient denied ever having had such a sensation.

Halo was noted in 8, and muscæ in 7 cases.

Glaucoma simplex is regarded as being a disease which runs its course without usually exhibiting any inflammatory signs. There are many cases, however, in which *irritation symptoms* manifest themselves, and this usually happens in the later stages of the disease. Fifteen of our cases were noted as having tarsal and ciliary congestion, but in several instances this was caused by accidental catarrhal disease of the conjunctiva. The vast majority were noted as being

quiet, and, beyond the external manifestations significant of the pressure within the globe, there was nothing to denote an inflammatory process.

The *pressure symptoms* were as follows: The anterior scleral vessels were noted as being engorged in 28 instances. The cornea was variously described as "steamy" and "needle-stuck" in 58 instances. This membrane was anæsthetic in 22 cases, and in 10 instances it was irregular and maculated. There were abnormalities in this membrane in 26.94 per cent. Probably on account of the advanced age at which the majority of the cases presented themselves, arcus senilis was present in 60 instances.

Study was made of the *anterior chamber* in those cases where the presence and the character of the excavation was noted, and it was found that—

In 64 eyes the a. c. was shallowed and the discs excavated.

In 10 eyes the a. c. were shallowed and the discs not excavated.

In 3 eyes the discs were excavated, but the a. c. were normal.

In the 10 cases in which no excavations were noted, there were pathological excavations in the fellow eye, giving rise to the thought that these 10 eyes were in an earlier stage of the disease, as evidenced by the shallowed chamber, and that excavations would appear later. In the last 3 instances, it is only fair to suppose that the angles of the anterior chambers were blocked, although in a manner which was imperceptible to the clinician. Except in 3 cases, where the chambers were unaffected, increased tension was always associated with shallowed chambers. But the converse did not hold, for in 15 cases where the chambers were markedly narrowed, the tension was noted as being normal.

The pupils were $2\frac{1}{2}$ *mm* in size in 75 instances. In 62 of these the irides responded freely to light and convergence, whilst in 13 they were sluggish to these stimuli.

The pupils were 3 *mm* in size in 62 instances. In 45 of these they responded equally and freely to light and convergence, whilst in 15 they were sluggish to these stimuli, and, in 2 instances, non-responsive.

The pupils were 4 *mm* in size in 38 instances. In all of these they responded equally and freely to light and convergence. In 17 they were sluggish, and in 10 non-responsive.

The pupils were dilated ad max. in 19 instances, in 5 of which they were sluggish, and in 14 non-responsive.

In regard to *the relationship existing between the size of the pupil, the presence or absence of an excavation, and the state of the tension*, a glance at the following table will show that neither increased tension nor the presence of an excavation was constantly associated with an enlarged pupil, although, in the vast majority of the cases—119 eyes (35.62 %)—where there were excavations, there were also enlarged pupils.

Table.

Pupils 2½ *mm*, T n., glaucomatous excavations = 15 cases.

Pupils 2½ *mm*, T +, glaucomatous excavations = 12 cases.

Pupils 3 *mm* or more, T n., glaucomatous excavations = 20 cases.

Pupils 3 *mm* or more, T +, glaucomatous excavations = 42 cases.

The media were noted as being clear in 47 instances. In addition to the 58 cases of corneal opacity, there were lenticular opacities in 95 instances. The nucleus of the lens was hazy in 36 cases, the cortex in 45, whilst in 14 the opacities were marked enough to have received the designation of cataract. Vitreous opacities were observed in 6 instances.

The Nerve.—Every nerve the seat of a glaucomatous excavation presented an abnormal tint. In 64 cases it was dirty red-gray, whilst in 41 instances it was described as gray. In 7 cases it had a greenish hue, and in 1 a bluish. In 2 it appeared waxy. It was hazy to the nasal side in 10 instances, and hazy all around in 2. In 5 instances there was a low-grade papillitis. The lymph sheaths were full in 6.

Excavations.—These were of all varieties, of varying de-

grees of depth and extent. Sixty-five were complete, 7 were undermined, 9 shallow, involving the entire surface.

103 were deepest out. 5 were deepest down and in.
35 were deepest down and out. 5 were deepest down.
7 were deepest up and out. 2 were deepest in.

The average depth of the excavation was 3.37 D.

Table.

Total number of eyes with pathological excavations possessing normal visual acuity = 32.

Total number of eyes with pathological excavations possessing normal tension = 72.

Total number of eyes with pathological excavations possessing increased tension = 91.

Total number of eyes with pathological excavations with contracted fields = 143.

Total number of eyes with pathological excavations with normal fields = 40.

In only 9 eyes with cut fields were there no glaucomatous excavations. In only 4 eyes with tension increased were there no glaucomatous excavation.

Glaucomatous excavations in one eye = 30.

Glaucomatous excavations in both eyes = 101.

Cases in which there was a probable excavation, but the haziness in the media prevented a view of the fundus = 21.

Significant and constant though the changes in the structure of the nerve head itself may be, those occurring in the scleral ring are no less worthy of mention.

Scleral Ring.—A broad scleral ring all around occurred in 147 cases; 33 times in beginning cases; 56 times in excavations to the temporal side; 40 times in complete excavations; 7 times in large shallow excavations, and 11 times in physiological excavations.

A broad scleral ring *out* occurred in 23 cases.

A broad scleral ring *in* occurred in 3 cases.

A broad scleral ring *up and in* occurred in 3 cases.

A broad scleral ring *down and out* occurred in 7 cases.

A broad scleral ring *in and out* occurred in 11 cases.

A broad scleral ring *down and in* occurred in 6 cases.

A broad scleral ring *up and out* occurred in 1 case (physiological excavation).

A faint scleral ring all around occurred in 3 cases.

Marked halo occurred 31 times. Choroidal rings and conuses showed a tendency to become absorbed to the temporal side, and more especially down and out.

The Visual Field.—A careful study was made of the visual field in 215 eyes, and a painstaking comparison of these fields with a view of determining the extent of the average field, which was instituted, resulted as follows:

The form field was contracted:

To 34.83 ° to the nasal side.

To 50.10 ° to the temporal side.

To 31.75 ° above.

To 43.71 ° below.

The contraction for red was:

To 20.53 ° to the nasal side.

To 31.75 ° to the temporal side.

To 19.35 ° above.

To 24.52 ° below.

Seventeen cases where the form field was abolished and the *candle field* was alone obtainable, showed an average contraction for this source of illumination to be—

To 26.27 ° to the nasal side.

To 33.81 ° to the temporal side.

To 34.81 ° above.

To 40.45 ° below.

In 10 of these cases, in addition to the glaucomatous process, the diminution in the field was occasioned by opacities in the media. These figures go to show that in the majority of cases the reduction in the peripheral vision took the form of a concentric contraction of the field throughout its entire extent. They show further that the disturbance in the perception of color goes hand in hand with that for form. In 32 cases, however, in which there were glaucomatous excavations the color field was found to be contracted proportionately more than that for form, and in 6 of the latter there were distinct cuts in both form and color fields.

In 44 cases (20.46 per cent.) there were distinct cuts, *i. e.*, entering angles in the field. These defects occurred in all portions of the field and did not show any predilection for any sector. In 19 of these cases, where there was concentric limitation to 20° to the nasal side, there was full visual acuity. Scotomata were noted as occurring in but 4 instances.

The extent of the visual field and the presence or absence of an excavation.—It was possible in 121 eyes to make a comparative study of *the tension, the vision,* and *the extent of the visual field* and *the presence or absence of an excavation.* The results obtained are as follows:

T n., good vision,[1] good field,[2] excavation present = 3.

T n., good vision, contracted field,[3] excavation present = 6.

T n., poor vision, good field, excavation present = 14.

T n., poor vision, contracted field, excavation present = 35.

T n., poor vision, contracted field, no excavation present = 5.

T +, good vision, good field, excavation present = 2.

T +, good vision, contracted field, excavation present = 6.

T +, poor vision, good field, excavation present = 10.

T +, poor vision, good field, no excavation present = 1.

T +, poor vision, poor field, excavation present = 37.

T +, poor vision, poor field, no excavation present = 2.

It will be seen at once by these figures that an excavation existed in all but 8 of these 121 cases. They also show how the diminution in vision, the contraction of the field, and the presence of the excavation go hand in hand. The influence of increased tension does not appear to have played so important a part, as it was noted as being normal in 53 instances, whilst there was full visual acuity in only 17 instances. In order to gain an idea as to which factor appears the more often a count was made of the total number of *ex-*

[1] Vision = 5–5 or 5–7 1–2.
[2] 55° nasal for form.
[3] Contraction to at least 30° nasal for form.

cavations which had been noted as appearing in the 334 eyes. Two hundred and seventy-two excavations were found described and of this number 245 were glaucomatous.

To these there must be added 21 eyes in which an ophthalmoscopic examination was impossible on account of haziness of the media, but where there was a probable glaucomatous excavation as evidenced by the presence of the other three cardinal symptoms *i. e.*, poor vision, contracted field, and increased tension.

In like manner cognizance was taken of the state of the *tension.* This had been noted in 199 eyes and in 109 instances it was increased. The *fields* were found to have been studied in 215 cases and in 96 instances they were contracted. To these must be added 44 blind eyes and eyes in which vision was reduced to l. p.

Table.

Eyes containing excavations, 272.
Eyes exhibiting increased tension, 109.
Eyes with contracted fields, 240.

A spontaneous venous pulse occurred in 22 cases and an *arterial* in 20. Of these latter, the pulse was induced by slight pressure on the globe in 6 instances. The veins were noted as being tortuous 12 times and the arteries 8. It is probable that anomalies in the vascular distribution occurred in a greater number of cases, but escaped description, varying degrees of tortuosity being supposed to exist in all cases where the pathological process was marked enough to impede the vascular supply. In about 20 per cent. of the cases the choroid was described as being congested, while evidences of retinal opacity were sufficient to deserve mention in a few instances.

Refraction.

According to many observers *hypermetropia* predisposes toward glaucoma, the shape of the globe in this form of ametropia and the peculiarities in the accommodative effort which accompanies it, being held responsible for the causa-

tion of the disease. In simple glaucoma, however, the character of the ametropia appears to have no relationship whatever in inducing this pathological state. It is true that the great majority of the 167 cases were hypermetropic, that form of ametropia being recorded as occurring in 140 eyes, but these figures do not disprove this assertion, for allowance must be made for the predominance of hypermetropia over other forms of ametropia. Eyes that were highly hypermetropic were not found to possess a greater liability to the disease than the lower grade of this anomaly, for in no instance was the degree of hypermetropia higher than 3 D. The average degree was 1.66 D. *Myopia* occurred 28 times. The average excess in the length of the globe being 1.94 D. Twenty-one patients had *emmetropic* eyes. Twenty eyes were *astigmatic*. Of these the axis of the cylinders were vertically placed in 11 instances and horizontally in 7. Mixed astigmatism existed in 2 cases. From observations elsewhere the authors are confident that astigmatism against the rule occurs in the vast majority of cases of glaucoma, and it has been a great disappointment that this belief was not substantiated by the examination of this series of cases. As would be expected from the predominance of hypermetropia and the age at which most of the patients came under observation, glasses had been worn for varying lengths of time and repeated changings of the correction on account of failure to relieve symptoms were very frequently noted. The average length of time during which glasses had been worn was ascertained to be 11½ years for near, and 15½ years for far. In 86 cases where the refraction error and *the range of accommodation* were noted in conjunction, 30 showed an absolute loss of accommodative power out of proportion to the age of the subject. In the remaining 56 cases accommodative power was normal. Tension was increased to 63.15 per cent. of the cases in which there was normal accommodation whilst in 36 (88 per cent.) it was diminished.

From a consideration of these findings the authors have embodied the thoughts which have been engendered into *the following conclusions:*

Simple glaucoma occurs in either sex with about the same degree of frequency, but manifests a preference for the eyes of males. The majority of cases occur in the beginning of the fifth decade. It is quite uncommon, occurring in about .736 per cent. of the cases which seek treatment at ophthalmic hospitals. All forms of ametropia are equally liable to this affection. With the exception of articular rheumatism and influenza, which appear to induce changes that favor its development, there are no other particular systemic diseases which predispose to it. It is a binocular affection, although a period of 20 months usually intervenes between the manifestation of the symptoms in the two eyes. The two most prominent subjective symptoms are failing sight and headache, but neither of these possess characteristics which would serve to differentiate them from those occurring in other forms of occular disease. This form of glaucoma is slowly progressive, 2½ years being the average length of time required to induce blindness after the appearance of the initial symptoms. Signs of irritation in the anterior segment of the eye are usually absent, but 4.52 per cent. of the cases exhibit such changes. An inflammation of the optic nerve is a constant attendant upon glaucoma, being noted in every eye containing a pathologic excavation. It manifests itself as a low-grade neuritis affecting the entire structure of the nerve, and seems to render the nervous tissue more liable to the peculiar kind of excavation which is the most constant characteristic of glaucoma. No one of the four findings most commonly observed in glaucoma is essential to the disease, for the disease may occur without an excavation, without the field being contracted, without the diminution of central visual acuity, or without rise of tension. The excavation, however, is the most constant symptom, occurring in 81.43 per cent. of all the eyes which were examined. Although the excavation shows a marked predilection to occupy the temporal half of the disc, no part of the nerve escapes. In exceptional cases the excavation appears at the temporal edge of the disc as a continuation of the physiological excavation. From here it gradually spreads over the head of the nerve, encroaching upon its structure until

only a narrow rim of nerve fibres remains at the nasal edge. Central visual acuity may remain normal although the field for form and color be encroached upon (in 10.77 of the cases.)

The tendency of the scleral ring to become visible all around the disc, and its disposition to broaden especially to the temporal side, are significant of the degree of intra-ocular tension to which the globe has been subjected, and go hand in hand with the extent and depth of the excavation. As the broadening of the ring however, usually appears before the excavation, its presence in eyes possessing other symptoms of glaucoma should always excite suspicion of this disease.

Opacities in the refracting media are found in an unusually large percentage (86.52 per cent.). These, however, are to be regarded as being more the result of senility than expression of the glaucomatous state. Arcus senilis (35.92 per cent.) and lenticular opacities (28.44 per cent.) are the most common, while corneal opacities, directly traceable to the increased intra-ocular tension, occurred in 20.38 per cent. of the eyes. Vitreous opacities occur in but few instances, and, originating in a choroiditis which complicates the disease, are not an essential feature of it.

The cornea is the most liable of the refracting media to be affected by the glaucomatous process. The increase in intra-ocular tension as determined by palpation is not necessarily a constant factor, being detected in 109 cases (32.63 per cent.). Where the tension is increased, the field will be distinctly cut or the nerve excavated. Rigidity of the sclera is often the first indication of increased, ocular tension. This rigidity may be accounted for either by a connective-tissue thickening in that tunic, or by an actual increase in the intra-ocular tension rendering the sclera more resistent to the examining finger. The shallowing of the anterior chamber exists in eyes where there is no excavation, but the converse is not true, for in every eye where there is an excavation the chamber will be shallowed. This would seem to show that the shallowing of the chamber occurred before the increased tension had excavated the nerve. As the chamber grows shallower and the tension higher the pupils will become larger, and the larger the

pupil the less will there be reaction to light. This is not always true, however, for in 12 instances where the tension was distinctly elevated, and there were well marked excavations, the pupils were but 2½ *mm* in size and they responded perfectly to light and convergence stimuli. Other signs of increased intra-ocular tension, such as the choroidal halo and the venous and arterial pulses occurring in such a small proportion of cases show that they are not constant factors of the disease, and their absence cannot be regarded as negative evidence for the existence of a glaucomatous state. Increased tension limits the action of accommodation in only 34.88 per cent. of the cases. In the great majority of the cases the limitation of the field consists in a concentric contraction for color and form to an equal extent.

The consideration of the relative amount of contraction in the form and color field, often adopted in the distinction between an atrophic and a glaucomatous excavation, is valueless, as the findings show that in quite a large proportion (13.06 per cent.) of the cases the color field was relatively more affected than the form. Indeed in 16 of these 32 cases (50 per cent.) the form field was normal whilst that for red was contracted to 20 degrees or less. Contrary to the findings of other observers, the most frequent type of restriction of the visual field consists in concentric limitation of the entire field and not in the contraction to the nasal side. The limitations of the field in this latter position in 7.92 per cent. of the cases evidenced that this portion of it was peculiarly liable to be affected by the glaucomatous process, for the other portions were not equally affected by the disease. Full fields are not inconsistent with glaucoma, for in 129 eyes where the state of the tension, the degree of the visual acuity, the character of the excavation, and the extent of the field were noted, 30 eyes did not exhibit any lessening in the extent of their fields for form or for color.[1] "The effect of the administration of eserine

[1] The observations which were made in regard to *treatment* have been published elsewhere (*Wills Eye Hospital Reports*, vol. i.), but for sake of completion the authors have incorporated the conclusions which they drew in that article.

and of the performance of iridectomy in checking the course of the disease is proportionately the same in the treatment of simple glaucoma. As operative procedures are always to be deprecated when other measures are equally valuable, eserine should be employed in all cases of the disease. If at the end of a month the extent of the fields has diminished, iridectomy should be resorted to, as there will be nothing further to expect from the action of the drug. If at the end of that time, however, an improvement is noted, as evidenced by a study of the field, the drug should be continued, as there is reason to expect that a beneficial action will be exerted for ten months upon the extent of the field and fifteen months upon the visual acuity. After iridectomy is performed there is ground to believe that the course of the disease will be checked for a period of 18 months in 50 per cent. of the cases. Eserine is powerless in 20 per cent., iridectomy in 10 per cent. of the cases. So that 10 per cent. of all cases of simple glaucoma will not be benefited despite all therapeutic measures which may be employed."

AN UNUSUAL CASE OF HYALINE BODIES IN THE OPTIC NERVE.

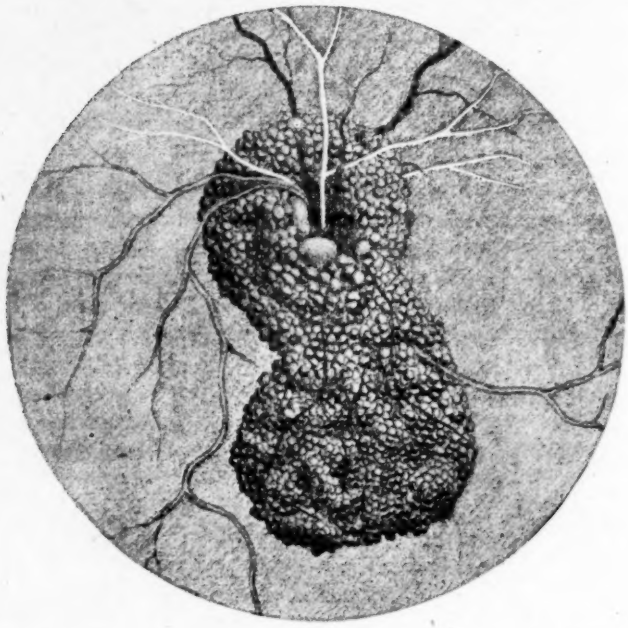
By Dr. H. GIFFORD, Omaha, Neb.

(*With one drawing in the text.*)

THE ophthalmoscopic picture presented by a pronounced case of hyaline bodies in the papilla is so remarkable and is so puzzling to one who has never seen nor read of it, that it is unfortunate that so little consideration has been given it in the great majority of text-books. Until the recent publication of Panas's work, the only text-books in which I have found it mentioned are that of Noyes and the little one of Swanzy. Graefe-Saemisch and De Wecker-Landolt have but a few words on the subject, and the ophthalmoscopic works of Mauthner and of Loring have nothing. The best description of the ophthalmoscopic appearances which I have found is in De Wecker and Masselon's *Ophtalmoscopie Clinique* (2d ed., p. 214). They there describe a case as altogether exceptional, in which the whole papilla and a little of the adjoining retina were covered with these bodies, the vessels, however, not being covered at all. More marked than this case is one figured by Nieden[1] in which the greater part of the optic disc, with parts of the retinal vessels on it, was covered by a mass of hyaline bodies which bulged into the vitreous to a height of more than 4 *mm.* (14 D.). The case which I shall first describe far exceeds any hitherto reported, in an otherwise normal eye, in the extent of the affection, beside being unusual in other more important particulars.

[1] Nieden, *Arch. f. Augenheilkunde*, xx., p. 73.

Sept. 16th, 1892, Zella K., a bright, healthy-looking girl eleven years old, came to my office with the following history: R. E. has been slightly turned in since infancy; nothing else unusual about eyes, until two years ago, when she had some trouble with the V. of both eyes and then noticed that V. of R. E. was much worse than that of L. E. At that time complained of slight pain in R. E. and it was examined by Dr. Thomas Kelly of South Omaha (through whose kindness the child was later sent to me),



who found the right optic disc to be covered with hyaline bodies. Since then she has noticed no change in the eye except that V. has got worse.

Stat. praes. R. E. slight convergent strabismus, pupil reacts only on indirect stimulus; V. = doubtful perception of light; eye otherwise normal, except for slight vitreous opacities and the conditions to be described at and about the optic disc. These conditions can best be understood by reference to the accompanying figure, which represents the appearance of the upright

image. The papilla and the surrounding retina, for a distance, in all directions, of about half the diameter of the average normal disc, was entirely concealed by a mass of hyaline bodies, the summit of which was 9 D above the rest of the fundus; below the papilla, this mass, after a slight constriction, was continued into another of about twice the diameter of the disc. The hyaline bodies were translucent, of somewhat pearly lustre, reminding one of half-soaked-up grains of tapioca. Near the centre of the disc, they seemed to have coalesced into two unusually large bodies. Near the temporal side of the main mass, some isolated whitish spots, probably, but not positively, of the same nature, could be seen either in the outer layers of the retina or the inner layers of the choroid. From the crater-like depression in the centre of the main mass, the superior and supero-temporal vessels could be seen emerging, while the remaining vessels ran through the mass for some distance before coming into view. The most remarkable thing about the vessels was the fact that the superior, supero-temporal, and supero-nasal arteries were entirely occluded and changed into glistening white bands from their points of emergence to a considerable distance out into the retina.[1] The supero-nasal branches were white to their terminations, while the superior and supero-temporal branches regained some color, though not a normal appearance, at from 4 to 5 papilla-breadths from the centre of the disc. In the vitreous, mostly in the posterior part, were a number of fine slightly reddish opacities evidently from comparatively recent hemorrhages. The rest of the fundus showed nothing abnormal. The other eye was normal throughout, unless a slight pallor of the outer half of the disc was pathological; V $\frac{20}{20}$ + H = 1.5 D; field and color-sense normal. Dr. Kelly, who is a competent ophthalmoscopist, assures me that when he first saw the case the vitreous was perfectly clear and that he noticed none of the changes in the arteries which were so marked at the time of my first examination. In the two years during which the patient has been under my observation, the vitreous opacities have cleared up entirely or nearly so, the mass of hyaline bodies has grown somewhat larger; and white lines have begun to appear along one of the arteries not, I think, affected when I first saw the eye. During the last eight months

[1] At a recent examination I have found that these white vessels are not entirely obliterated, but have a very small blood stream in the centre of each one. It is quite possible that I overlooked this in earlier examinations.

there has grown from the lower of the larger masses, at the edge of the central depression, a body, apparently of the same substance as the other hyaline bodies, but differing in shape from anything which I have seen described in this connection. When first seen six months after the next preceding examination it was somewhat trumpet-shaped, the flaring end, nearly a half papilla-breadth in diameter, projecting out into the vitreous and containing a deep depression, while the tapering end was attached to the large hyaline body at its central edge. Within the last two months the shape of this growth has changed so that it is now irregularly cylindrical, the end which projects into the vitreous being bluntly conical, like a revolver bullet, and apparently hollow. I have not attempted to have the sketch altered to represent this growth.

This case is unique in several particulars. The only reported case which compares with it in the extent of the affection is that of Remak.[1] He observed, in a patient with retinitis pigmentosa, a series of clumps of hyaline bodies which had obliterated the papilla and extended for some distance into the retina. This case, however, could not be examined with perfect accuracy, as the eye had nystagmus.

The changes observed in the vessels, in the case of my patient, are even more unusual than the extent of the affection. Where the hyaline bodies exist as a complication of retinitis pigmentosa, it is, of course, common to find the vessels much reduced or even, as in Remak's case, nearly absent from the entire retina; but aside from this, in the other cases hitherto reported, the vessels, though sometimes partly covered, have shown no changes that could in any way be connected with the hyaline bodies.

Another unusual feature in the case is the age of the patient. So far as I can learn the youngest patient hitherto described with hyaline bodies in the optic nerve is one of Ancke's[2] who was fourteen years old, the eyes also being affected with retinitis pigmentosa. Excluding eyes with retinitis pigmentosa, the youngest patient that I find

[1] Remak, *Centralblatt f. Augenheilkunde*, ix., p. 257.
[2] Ancke, *Centralblatt f. Augenheilkunde*, ix., p. 167.

reported is one of Stood's,[1] a seventeen-year-old girl. My patient was first found to have an enormous development of these bodies at the age of nine years.

Whether in this case the blindness was due solely to the development of the hyaline bodies, or whether the development of the latter was simply favored by some foregoing disease of the optic nerve, is impossible to decide.[2] Be this as it may, the changes which have taken place in the vessels and which appear still to be going on, to some extent, indicate that we ought to take with some reserve the statement of Terson,[3] that the prognosis, so far as the effects of these bodies themselves are concerned, is absolutely good. One of Nieden's patients had a reduction of vision, probably due to the effects of the hyaline bodies alone; and another case, which I have observed, also gives the same indication, besides having other points of interest. This was the case of J. D., a robust-looking man about forty-five. For a year or two he had noticed a blur coming suddenly before the eyes, when looking intently at anything. I found the vision to be R. E. $= \frac{20}{40}$ — L. E. $= \frac{20}{40}$ —; no improvement by glasses; fields normal for white but R. E. shows decided contraction for blue, yellow, and red; and L. E. for blue and yellow. Vision blurs unusually quickly during these tests and statements become conflicting. The only condition to account for the defects of sight, was a marked development of hyaline bodies in both optic discs. In the right eye, these bodies covered the whole nerve and all its vessels with the exception of a small area in the centre which was free from them. In the left eye, the conditions were much the same, except that the free area in the centre of the disc was larger. In all other respects, the eyes were perfectly normal. This man was apparently in robust health and as there was nothing in the case to indicate any kidney trouble, I am not sure that the urine was examined. If it was, no abnormality

[1] Stood, *Zehender's Monatsblätter*, 1883, p. 512.

[2] Stood's two cases are supposed to show a relation between optic neuritis and hyaline bodies in the papilla; but as in one case the bodies were found less than four weeks after the visual disturbance began, they had probably existed long before the neuritis occurred; while in the other case, it is not at all certain that there had ever been a neuritis.

[3] Terson, *Archives d'Ophtal.*, June, 1892, p. 374.

was found and no record was made of the test. About a year later, however, he developed symptoms of Bright's disease and died at about the end of another year.

If the eyes of this man had been examined, microscopically, by some one who had not seen him before his kidney trouble developed, the case would have been reported as one of hyaline bodies in connection with Bright's disease; whereas, in all probability, these bodies had existed in the nerves for some time before the kidneys were diseased. Hitherto, Bright's has been supposed to stand in some causal relation to these bodies on the strength of the case of Gurwitsch[1]; but it seems to me that this case proves even less with regard to any such connection than the case just described. In examining the eyes of a patient who had died of nephritis, he found hyaline bodies in one nerve-head (not in the other), but there was no evidence to show whether the nephritis or the hyaline bodies had had the earlier origin.

With regard to the controversy as to whether these bodies, as occurring in the nerve-head, are related to the similar bodies which grow from the elastic layer of the choroid, it is evident from microscopic examinations that they often occur at some distance from the main ending of the lamina elastica, at the periphery of the nerve. But if, as Kuhnt asserts, this layer sends off fine prolongations into the substance of the nerve, it is quite possible that the bodies take their origin from these prolongations. Hirschberg and Cirincione,[2] who have been the main upholders of the view that these bodies, in the nerve-head, are of an entirely different nature from the "Drusen" of the choroid, insist upon the fact that the latter are covered with epithelium, and sometimes contain epithelial cells in their centres, while the "Drusen" of the nerve-head show nothing of the kind. This difference, it seems to me, can be explained by the relation of the "Drusen" of the choroid to the epithelial layer of the retina. The latter, lying as it does in immediate

[1] Gurwitsch, *Centralblatt f. Augenheilkunde*, August, 1891.
[2] Hirschberg and Cirincione, *Centralblatt f. Augenheilkunde*, June-July, 1891.

contact with the lamina elastica, would naturally form a covering for the excrescences from the latter, and might easily have some of its cells incorporated into them by being pinched off between two or more "Drusen" in the process of coalescing. In the nerve-head, of course, there is no chance for any thing of the kind to occur. On the other hand, it seems that the one pathological process which stands in an undoubted relation to the causation of these bodies, in the nerve, is retinitis pigmentosa, and in this disease, also, "Drusen" in the choroid are extremely common.

But whatever the exact starting-point of these bodies may be, it is evident that they do not grow simply by the degeneration of the pre-existing tissues of the part; nor does it seem likely that they are of the nature of excretions, for there are no structures in the nerve-head to excrete them. Apparently, given, from whatever cause, a nucleus for one of these bodies, it grows, within certain limits, by deposition on its surface from the fluids of the body; something as a crystal increases in size, when hung in a solution of the same substance.

Finally a word as to a matter of priority. Hirschberg mentions the case described by himself and Cirincione as the first in which test of vision, ophthalmoscopic examination, and microscopic examination had been made; but it is evident from a comparison of his text with that of De Schweinitz[1] that it is to the latter's case that this distinction properly belongs; for in Hirschberg's case, although the ophthalmoscope was used, it is plain that the hyaline bodies could not be seen, on account of a turbid vitreous.

[1] De Schweinitz, *Trans. American. Oph. Soc.*, 1892.

AN ORBICULARIS PUPILLARY REACTION.

By Dr. H. GIFFORD, Omaha, Nebraska.

FOR some years I have been observing a pupillary reaction of which I have found no mention in the ophthalmic and physiological literature at my disposal. The only reactions noted in the larger handbooks, as well as in the most recent text-books, such as those of Panas and of Roosa, are, first, contraction on exposure to light and on efforts of accommodation and convergence; second, dilatation on the withdrawal of light and on the stimulation of the sensory nerves in various parts of the body, as well as in certain emotions.[1]

The reaction to which I refer is a contraction of the pupil which takes place when a forcible effort to close the lids is made. This, for reasons to be given later, can be best observed on a subject blind, or nearly so, from some disease of the retina, optic nerve, or brain. When such a subject, with the eyelids held apart by the observer, is told to shut the eyes tightly, the pupils, if the eyes are not rolled up too sharply, are almost always seen to contract perceptibly, and sometimes very markedly. Sometimes the eyes are rolled up so far that the pupil is not visible while the contraction of the orbicularis is going on, but as soon as the latter is relaxed and the pupils come down into view they are seen, for an instant, to be contracted, though they dilate again promptly to the average, or rather more than average size. With subjects having good vision, this reaction often cannot

[1] The cortical reflex described by Haab (*Jahresbericht f. Ophthalmologie*, xxii., p. 51) is not mentioned in any ordinary text-book that I have seen, but is thoroughly considered in Knies's work, *The Eye in General Diseases.*

be observed, except under special conditions, because the contraction maintained by the light of an ordinary well-lighted room is greater than that caused in most eyes by the orbicularis contraction; therefore it is best to use the dark room, having enough light come from one side to allow the changes in the pupil to be easily observed. Under these conditions the reaction mentioned can be seen plainly in the great majority of eyes; in a few it is very slight, while in a still smaller percentage it is so slight that it is questionable whether it occurs at all. As before mentioned, this contraction of the pupil is best demonstrated by having the subject try to close the lids tightly while they are forcibly held open (it is better to hold the lids of *both* eyes open during the test); but in many people this holding open is not necessary; if they simply shut the lids tightly, the pupils, when the lids are opened quickly, are seen to be contracted, though not so much so as when the lids are held open; this, however, requires a quicker and more careful observation than when the lids are held open, for the sudden access of light often causes a still sharper contraction of the pupil than that caused by the orbicularis reflex.

I speak of this pupillary contraction as the orbicularis reaction, mainly for the sake of brevity, since it will be difficult or impossible to prove that the stimulus for the pupillary contraction comes solely from the orbicularis centre. It is probable, I think, that it is simply the result of an overflow stimulus; that is, the intense activity which the attempt to close the lids excites in the cells of the nucleus of the orbicularis fibres of the facial, overflows, so to speak, into the cells of the pupil-contraction-centre. That this reaction is not merely the result of a stimulation of the convergence centre is shown by the fact that, in many cases, when the attempt to close the lids is made, the eyes can be plainly seen to be slightly divergent. Generally, when the subject is told to shut the eyes tightly, the eyes turn up and make a conjugate lateral movement to one side or the other, or alternately from one side to the other; more rarely there is some convergence at first, but in nearly all cases, if the attempt to close the lids is continued, the axes become more

or less divergent (the pupil-contraction continuing meanwhile), and remain so until the orbicularis contraction is relaxed. The fact that, in some of the cases in which the orbicularis pupil-reaction could be observed but slightly, or not at all, the patients, when told to shut the eyes, kept looking straight ahead instead of rolling the eyes up, made me suspect that the pupil-contraction might depend upon the action of the superior rectus; and I have found, as a matter of fact, that, with some people, a slight pupil-contraction does take place when they simply look up sharply; but this superior rectus pupil-contraction does not begin to equal in constancy or extent that occurring with the orbicularis contraction.

It is more difficult and perhaps, for most cases, impossible to prove that the orbicularis contraction does not cause the pupil to contract solely by exciting the action of the accommodative muscle, the latter then exciting the pupil-sphincter. But, in some cases, it can be clearly shown that this is not the case, since with these patients the utmost exercise of the accommodation and convergence fails to produce as marked a contraction of the pupil as that caused by the forced attempt to close the lids.

For example, in the case of Z. K., a girl of thirteen, blind in the right eye, but with vision $\frac{20}{30}$—and normal accommodative power in the left eye, the pupils contract only to about 6 *mm* in diameter when objects are fixed at the near point or nearer, while the forced action of the orbicularis causes them to contract to about 3 *mm*. I have seen several similar cases, some of them in patients with both eyes normal. In the great majority of cases, if the test is made by good daylight, or even by gaslight coming from the side in a dark room, the pupil-contraction accompanying convergence and accommodation is greater than that caused by the orbicularis contraction; but if the light is made as dim as is consistent with accurate observation, it will every now and then be found that the near-vision contraction does not equal the orbicularis contraction. This indicates that, while the orbicularis reaction is independent of the light stimulus, the contraction of the pupil accompanying near vision does

not reach its maximum except by good light.[1] An additional proof of the independence existing between the contraction of the pupil caused by the orbicularis, and that accompanying the contraction of the ciliary muscle, I have found in several pathological cases, where no perceptible contraction of the pupils occurred on stimulus from light, convergence, or accommodation, while the orbicularis test produced a distinct though slight contraction of the pupil.

I have referred to the fact that when the person observed looks straight ahead, while trying to close the eye, the pupil-reaction is less marked, or not at all observable. At least a partial explanation of this is to be found in the independent action of the different parts of the orbicularis muscle; the parts which control the lids proper can act with entire independence of those which pull down the eyebrows and pull up the tissues of the cheeks. Now, the orbicularis pupillary reaction seems to be mainly, if not wholly, dependent on the action of the parts which move the lids alone, and some people, while apparently trying hard to shut the eyes when the lids are held open, really make little or no effort with the strictly palpebral portions of the orbicularis, but expend all their energy on the more peripheral portions of the muscle, and this is especially true if the gaze is kept fixed on some object straight ahead. I judge that it is chiefly the palpebral portions of the muscle that cause the pupil reaction, because when experimenting with myself, if, with the lids held apart, I strongly contract the more peripheral portions alone, I find that I can easily keep my eyes directed at any point which I choose to look at; and under these circumstances (as my colleague, Dr. Overholt, tells me) there is not only no contraction of the pupil, but even, at times, a slight dilatation; while, if I strongly contract the palpebral portions alone (the lids being held open), I find it impossible to keep looking straight ahead, the eye turns up, and the pupil contracts sharply. I have also found this connection between the pupil-reaction and the strictly palpebral por-

[1] This may be due, in part, to the imperfect vision by the dim light. Wolffberg has recently asserted that the extent of the pupillary contraction, in near vision, varies directly with the acuity of vision obtained by the accommodative effort which causes the contraction.

tions of the orbicularis to obtain in several other cases which I have examined with especial reference to this point, but it is not every patient that has the intelligence to make the test satisfactory.

With regard to the importance of this pupillary reaction from a pathological standpoint, I can say but little. It sometimes persists when all other non-medicinal myotic reactions fail, but as it occasionally cannot be demonstrated in normal subjects, it will be difficult to give to its absence a distinct pathological significance. The reaction is of use in determining whether the pupil-sphincter is paralyzed, in cases where the ordinary tests fail. In several cases of suspected brain tumor, for instance, where the pupils showed no contraction on light, convergence, or accommodation (the failure of the last two being probably, more or less, due to the poor sight), I have found the pupils to contract promptly on forced contraction of the orbicularis. In similar cases, it may also serve to eliminate the possibility that the dilatation of the pupil is due to a mydriatic having been used by some previous observer.

From a physiological standpoint this pupil-reaction is interesting as tending to confirm either the views of Mendel (*Berlin. klin. Wochenschrift*, 1887, 48, p. 913), who claims that in rabbits the fibres of the facial which supply the orbicularis, arise, not from the common facial nucleus, but from the posterior part of the oculomotor nucleus, or those of Bechterew (cited by Noyes, *Diseases of the Eye*), who asserts that special fibres connect the nucleus of the oculomotor with that of the facial nerve. The fact that the reaction seems to depend more particularly, if not entirely, on the action of the palpebral portions of the orbicularis, indicates, perhaps, that, in man, it is only the nerve fibres supplying these portions, which have an oculomotor origin; or, at least, that the nuclear cells of these fibres are most intimately connected with the main body of the oculomotor nucleus.

TREATMENT OF SYPHILITIC AFFECTIONS OF THE EYE BY MERCURY, POTASSIUM IODIDE, AND PILOCARPINE COMBINED.[1]

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July, 1894, a man consulted me suffering from syphilitic inflammation of both eyes of nine months' duration at least. His physician had been treating him for acquired syphilis since December, 1893. Three months or so prior to this his eyes became affected while under the supervision of another physician. From December, 1893, to July, 1894 he had received antisyphilitic treatment in the form of mercury and the iodide of potash. Atropine was also used locally during the entire winter. This latter remedy had not been used for two weeks prior to consulting me.

The condition of the eyes July, 1894, was as follows:

Left eye.—Much conjunctival, subconjunctival, and ciliary injection, pain at times, aqueous turbid, many lymph dots on the posterior surface of the cornea, very many posterior synechiæ, some being broad and dense, with the thin deposit of lymph in the pupillary area. V = perception of light only.

Right eye.—No letters of Snellen type at twenty feet, and only letters of No. XL. of the same type at eight inches; cornea and aqueous very slightly affected, posterior synechiæ more numerous and broader so as almost to be without a break, *i. e.*, so as to form almost one solid ring of adhesion, and the lymph deposit in the pupillary area denser. He said that his vision was now much worse than three months previously. I continued the administration of mercury and the iodide of potash internally, and atropine

[1] Read before the Toronto Medical Society, February 7, 1895.

locally. At the end of four weeks no improvement had taken place, in fact the eyes were slowly getting worse. I now made a change in the treatment as follows: I still continued the internal use of mercury and the iodide of potash, but added pilocarpine, giving it hypodermically. I began with gr. $\frac{1}{8}$, and gradually increased it to gr. $\frac{1}{4}$. I continued this for three weeks, and then again in three weeks for two weeks more, and again in five weeks for two weeks longer. While in use the pilocarpine was given every day, unless its administration gave rise to nausea, headaches, or oppression over the region of the heart, when it was stopped for one or two days, or perhaps the dose reduced only. After one week an improvement could be seen; at the end of three weeks it was quite evident, and at the termination of fifteen weeks or so the vision was $\frac{20}{60}$ Snellen.

The posterior synechiæ had been steadily thinning so that the broad dense bands began to look quite attenuated and weblike.

An interval of rest of eight weeks was given, the mercury and the iodide of potash, however, being continued. I may here mention that he has steadily taken the mercury and the iodide since he came under my care. At the expiration of this time the pilocarpine was again given hypodermically for ten injections. Some of the posterior synechiæ above mentioned have now given way, and such an alteration has shown itself in those that remain, that I feel assured that by persistence in treatment all these iritic adhesions will be removed. The deposit of lymph, once markedly present in the pupillary area, seems to be practically gone in the left eye and much lessened in the right. The vision is R = $\frac{20}{40}$, L = $\frac{20}{40}$.

I may also mention that since the pilocarpine was given, the improvement, that then began, has been uninterrupted.

The progress of this patient under the combined treatment has been most interesting to me. It has not only shown the apparent inertness of the powerful remedies, mercury and the iodide of potash, but also the immediate and brilliant results of the combined use of mercury and the iodide of potash internally and pilocarpine hypodermically.

We all know that the vigorous and long-continued use of mercury and the iodides has too often had far from a satisfactory effect not only in syphilitic affections of the eye, but also in syphilitic lesions in other parts of the body, as I think

has again been exemplified in this case. The addition of pilocarpine, however, produced such a markedly beneficial effect that I feel justified in claiming for this combined form of treatment a position as a most valuable and important addition to our means of treating syphilitic affections of the eye, and if of the eye, why not of any other part of the body that may be affected. From the manner in which this combined form of treatment has acted upon long-standing iritic adhesions, I feel it ought to be exceptionally useful in syphilitic lesions of long duration.

Pilocarpine has been used to a limited extent in syphilis; but I have never heard of its employment combined with mercury and the iodide of potash as is now brought before the attention of the profession.

It is not from this case alone that I have drawn my conclusions; for others, not so typical, have, however, all contributed to strengthen my belief in its efficacy.

The above mentioned treatment has ever since been carefully followed out, and is still being continued with such gratifying results, that with permission, I purpose later on publishing them in this journal.

SYSTEMATIC REPORT ON THE PROGRESS OF OPHTHALMOLOGY IN THE FOURTH QUARTER OF THE YEAR 1894.

By Dr. ST. BERNHEIMER, in Vienna; Prof. C. HORSTMANN, in Berlin; and Dr. P. SILEX, in Berlin;

with the assistance of

Dr. S. M. Burnett, Washington; Dr. Dantone, Rome; Dr. Herrnheiser, Prague; Prof. Hirschmann, Charkow; Dr. P. von Mittelstädt, Metz; Dr. Sulzer, Geneva; Dr. Werner, Dublin; Dr. C. H. A. Westhoff, Amsterdam; Dr. Schiötz and Dr. Ole Bull, Christiania; Dr. R. Greeff, Berlin; Dr. Deus, Berlin; and others.

Translated by Dr. Ward A. Holden.

Sections I.–V. Reviewed by Dr. ST. BERNHEIMER.

I.—GENERAL OPHTHALMOLOGICAL LITERATURE.

TREATISES ON GENERAL, BIBLIOGRAPHICAL, AND HISTORICAL SUBJECTS. STATISTICAL REPORTS.

1. Puccioni. The eye clinic of the Royal University of Rome in the year 1893–94. *Boll. d'Ocul.*, xvi., 13, 15, p. 101.

2. Vienna. *Year-Book of the Imperial Hospitals for 1893.* Eye departments, p. 276 *et seq.*

3. Bjerrum. Mechanism of accommodation. *Med. Aarsskrift.*, Copenhagen, 1894.

4. Greeff. The retina of the vertebrates. Investigations with the Golgi-Cajal silver-precipitation method and Ehrlich's

methylene-blue stain. A translation and collection of the works of Ramon y Cajal, done with the assistance of the author. Bergmann, Wiesbaden, 1894.

5. HAAB. Atlas and elements of ophthalmoscopy and ophthalmoscopic diagnosis. *Lehmann's Medical Hand Atlases*, No. vii., 1894.

In the Rome (1) clinic, according to PUCCIONI, 95 patients were admitted, 34 extractions being done, and 778 patients treated as out-patients. DANTONE.

In the public hospitals of Vienna (2) in 1893 855 cataract extractions were done ; 800 with good success, 39 with moderate, and 15 with bad result. One patient died. 263 iridectomies were made for optical purposes, 93 for glaucoma, and 13 as preparatory operations, and 123 eyes were enucleated. HERRNHEISER.

GREEFF (4) has undertaken the laborious work of translating, arranging, and annotating the rather inaccessible and extremely valuable papers of Ramon y Cajal on the retina. The introduction by the translator, treating of the Golgi-Cajal and Ehrlich methods, is very welcome. The excellent original illustrations increase the value of the book, which has been well gotten up by Bergmann. The different chapters treat of the retina of the teleosts, frogs, reptiles, birds, and mammals. It is an invaluable book for him who would keep posted on the present status of our knowledge of the retina.

HAAB'S atlas (5) is an excellent work and is cheap. The selection of the illustrations is good, and the short descriptions are adequate. Although in artistic execution the plates are inferior to Jaeger's, its fulness and cheapness will recommend it both to the student and the practitioner.

II.—GENERAL PATHOLOGY, DIAGNOSIS, AND THERAPY.

6. CUÉNOUD. Clinical bacteriology and parasitology of the lids. *Thèse de Paris*, 1894.

7. BLOCK. The healing of corneal wounds under the use of cocaine. *Medisch. Weekblad.*, 1894.

The various staphylococci are frequently found on the lid margins, particularly at the insertion of the cilia. CUÉNOUD (6), however, has never found streptococci here in the healthy lid. The most frequent lid affections are caused by staphylococci.

The Staphylococcus aureus is found in ulcerous blepharitis and hordeolum, the Staphylococcus albus in dry blepharitis. SULZER.

BLOCK (7) made experiments on the influence of cocaine on the healing of corneal wounds. In opposition to Mellinger, he found that cocaine had no injurious influence.

III.—INSTRUMENTS AND REMEDIES.

8. GUAITA. Formol in ophthalmology. *Ann. di Ottalm.*, xxiii., 5, p. 360 ; and *Lo Sperimentale*, xviii., p. 33.

9. DANESI. An antiseptic medicament in ocular surgery. *Boll. d'Ocul.*, xvi., 13, p. 100.

10. OSTENGO. Sea-bathing for ophthalmias. *Ibid.*, xvi., 14, p. 108.

11. VACHER. On permanganate of potassium in ocular affections. *Ann. d'ocul.*, cxii., p. 419.

12. DARIER. Subconjunctival injections once more; their theory, practice, indications, and contra-indications. *Ann. d'ocul.*, cxii., p. 381.

13. ARMAIGNAC. On the employment of antiseptics, caustics, and anilin dyes in ophthalmology. *Soc. de méd. et de chirurg. de Bordeaux*, Oct. 12, 1894. *Ann. d'ocul.*, cxii., p. 340.

14. BRUN. On the disinfection of the conjunctival sacs. *Presse méd.*, Oct. 27, 1894.

15. ANDOGSKY. On the employment of formaldehyd for preserving eyes for operative work. *Wratsch.*, No. 41, 1894.

16. PATOJENKO. The action of scopolamine hydrobromate on the healthy and diseased eye. *Teschenedjelmk*, No. 27, 1894.

17. DUJARDIN. A new fixation forceps for eye operations. *Ann. d'ocul.*, cxii., p. 396.

18. SCHÖBL. Optotypes—for Bohemian physicians. *Franz Deutike*, 1895.

19. GROVE. Graduation of the arc on Javal's ophthalmometer and the graduation on a straight arm. *Annals of Ophth. and Otol.*, Oct., 1894.

20. KUNN, CARL. Suggestion for a modification of the ophthalmoscope. *Wiener klin. Rundschau*, No. 2, p. 19, 1894.

21. TROMPETTER. A lid elevator for cases of entropium. *Zehender's klin. Monatsbl.*, xxxiii., p. 30.

22. JACKSON. Value of the ophthalmometer in practical refraction work. *Trans. Amer. Ophth. Soc.*, 1894.

23. BAKER, C. H. Results of subconjunctival injections in some eye diseases. *Annals of Ophth. and Otol.*, Oct., 1894.

24. PRENTICE. On the practical execution of ophthalmic prescriptions involving prisms. *Amer. Journ. of Ophth.*, Jan., 1895.

GUAITA (8) considers formol an important antiseptic. Strong solutions kill the microbes, and weaker solutions prevent the development of cultures. Irrigation with a 0.2 % solution produces asepsis of the conjunctiva often lasting twenty-four hours, which is not obtained by the use of other antiseptics—even bichloride. DANTONE.

VACHER (11) uses 0.1 %-0.2 % solutions of permanganate of potash for irrigating the conjunctiva, nose, and auditory canal when these are the seat of excessive suppuration. Such solutions are also useful when used as injections through the tear passages. SULZER.

Without giving new case histories, DARIER (12) presents a condensed statement of the present status of the question of subconjunctival injections of bichloride. The different theories of absorption, the objections to the method, and its indications and contra-indications are all fully treated.

ANDOGSKY (15) preserves enucleated eyes by keeping them for five to seven days in a 0.5 %-0.1 % solution of formaldehyd, when they may be used for operation courses; the transparency of the cornea and the tension of the eye being preserved. HIRSCHMANN.

Scopolamine, according to PATOJENKO (16), is more energetic, but more transitory in its action than atropin. Its power of easing pain is considerable. It causes no symptoms of irritation. Eserin contracts the pupil more readily after scopolamine than after atropin. A solution of 1:1000 is sufficient. HIRSCHMANN.

In the paper GROVE (19) discusses the construction of the ophthalmometer: (1) the finer markings on the arc indicating the radius of corneal curvature as constituting an arithmetical series; (2) the graduation of the arc for double movable mires; (3) the graduation on a straight arm for a single movable mire; (4) the graduation on a straight arm for double movable mires. BURNETT.

JACKSON (22) finds the ophthalmometer useful as an approximative test. In only 6 % of the 500 eyes examined by him did the total astigmatism correspond with the corneal in both degree and direction of its axis. In 16 % additional the corneal and total astigmatism was the same in degree, only the difference was 0.25 D in 21.6 %; 0.5 in 20 %; and so on up to 1.5 to 3.5.

BURNETT.

BAKER (23) has used subconjunctival injections of bichloride with success in cases of interstitial keratitis, choroiditis, and chorio-retinitis. He uses a very weak solution, 1 to 30,000.

BURNETT.

PRENTICE (24) pointed out some time ago the law that the decentration of a lens for 1 *cm* gives a prismatic action of 1 prism diopter (△) for every diopter of lenticular refraction. This paper is a further amplification of that law, with the suggestion that, for the weaker lenses, from 0.25 to 2 D, the diameter of the lens be 6 *cm* in order to increase the possibility of use of such lenses in decentration for prismatic effect. BURNETT.

IV.—ANATOMY.

25. LUGARO. On the origin of the fifth, sixth, seventh, and eighth cranial nerves. *Arch. di Ottalm.*, ii., 3–4, p. 116.

26. BELLI. On the distribution of neuroglia in the optic-nerve chiasm in man. *Ibid.*, ii., 1–2, p. 19.

27. RETZIUS. Investigations on the ciliary ganglion. *Hygiea*, No. 9. *Svench. Läkarevell. Förhandl.*, p. 154, Stockholm, 1894.

28. NICOLAI. Form of the anterior surface of the lens. *Medisch. Weekblad*, 1894.

BELLI (26) describes the relations and the appearance of the processes of the neuroglia cells in the arched zones of the human chiasm. DANTONE.

RETZIUS (27) has found that the ciliary ganglion is a true sympathetic ganglion like the other ganglia of the head.

SCHIÖTZ.

NICOLAI (28) has endeavored to get the true form of the anterior surface of the lens. For this purpose he constructed an instrument by means of which he could measure a deflection of $\frac{1}{10}$ *mm*, and he also made plaster casts of pigs' lenses. He found that the relaxed lens is regularly curved. WESTHOFF.

V.—PHSIOLOGY.

29. SPALITTA. Effects of extirpation of the ganglion of Gasser, after the destruction of the superior cervical ganglion. *Arch. di Ottalm.*, ii., 1–4, p. 37.

30. FERRI. On the size of the field of view in the ophthalmoscopic examination. *Ann. di Ottalm.*, xxiii., 3–4, p. 180.

31. FERRI. Determination of the angle α with the perimeter. *Ibid.*, p. 175.

32. ANGELUCCI. The visual function of the aged, and its effects on the employment of color in painting. *Arch. di Ottalm.*, ii., 1–5, p. 3.

33. GULLSTRAND. A photographic ophthalmometric method and the results obtained with it, together with a method of clinical determination of the curvature of the cornea in its periphery. *Hygiea*, No. 8. *Svensk. Lakeresellsk. Förhandl.*, p. 128, Stockholm, 1894.

34. REBOUD. The position of rest of the eyes. An experimental study. *Arch. d'opht.*, xiv., 11, p. 681.

35. OSTWALT. Ophthalmotonometric studies. *Graefe's Archiv*, xl., 5, p. 22.

36. GRAEFE, ALFRED. Accommodation and convergence. *Ibid.*, xl., 5, p. 247.

SPALITTA (29) reports various experiments made to determine the influence of the trigeminus on the nutrition of the coats of the eye, after destruction of the cervical sympathetic. DANTONE.

FERRI (30) again describes his method of measuring the extent of the fundus seen in the direct and indirect ophthalmoscopic examination. This method differs from that of Helmholtz, and the resulting values are greater. DANTONE.

ANGELUCCI (32) reports on the examination of the eyes of 100 individuals between the eyes of 60 and 80, as well as 14 painters, in respect to acuteness of vision, light sense, and color perception, and discusses in an intelligent manner the influence of the age of a painter on the chiaroscuro and coloring of his pictures, which often differ from those painted in early life. Many painters are mentioned whose late work showed much improvement on their earlier work, and his statements in regard to them are very interesting. DANTONE.

GULLSTRAND (33) gets his illumination with two very strong lamps, and photographs the corneal image of an illuminated black

disc with white concentric circles arranged in such a way that the size of the corneal image is directly proportional to the radius of the surface. Thus a single photograph gave 7 measures of the radius of curvature of the cornea in every meridian, and it was found that the applanation is relatively slight in the centre of the cornea, while it is more marked in the marginal zones, and is asymmetrical in both the vertical and horizontal meridians. The sum of the applanation up and down is greater than the sum of the applanation outward and inward. SCHIÖTZ.

Following Snellen's method, REBOUD (34) determined the position of rest, taking also into account refraction and acuteness of vision, in a number of soldiers (P = parallelism ; C, convergence; D, divergence). In E., P and D predominate ; with diminished acuteness of vision in one eye, a tendency to C ; with further diminution, a tendency to D. In H., with moderate or diminished acuteness of vision, there is mostly C, due to accommodative effort. In M., with good sight, there is also C, due, according to the author, to the frequent existence of astigmatism, leading to accommodation in the effort to increase the acuteness of vision. In H. A., even with good V, the tendency is mostly to P or D. In M. A., C is more frequent than in H. A., but there is no fixed rule. In anisometropia, C is frequent. Therefore, P and D are the positions of eyes which see without a strain, or in which V is poor ; while particularly in the accommodating eyes of H., C is present. The length of the basal line had no influence on the position. In all refractive conditions, vertical deviations were found, and the position of one eye frequently differed from that of the other, particularly in cases of anisometropia, while good and equal sight in the two eyes favors a similar position. Diminution of V, or the strain to increase V, leads readily to the abandonment of binocular vision and then to squinting, in the development of which latter the determination of the position of rest is of little importance. V. MITTELSTÄDT.

OSTWALT's (35) ophthalmotonometric investigations led him to the conviction that measurements made with Maklakoff's tonometer have a more objective character than those made with Fick's instrument. For absolute measurement Fick's tonometer is preferable, provided that the observer is somewhat practised in its use. The author believes, moreover, that the inadequate method of Bowman, of determining tension by the touch, should give place to the use of a tonometer.

Sections VI.–XI. Reviewed by Prof. HORSTMANN.

VI.—ANOMALIES OF REFRACTION AND ACCOMMODATION.

37. RICCHI. The anomalies of vision in 45,000 observations. *Boll. d'Ocul.*, xvi., 9. p, 55.

38. NIEBUHR. A contribution to the operative treatment of myopia. *Inaug. Dissert.*, Halle, 1894.

39. CHAUVEL. Ophthalmoscopic studies. Hyperopia. *Rec. d' opht.*, 1894, p. 573.

40. RAIA. A summary exposition of the causes, effects, and treatment of asthenopia. *Ann. di Ottalm.*, xxiii., 3-4, p. 222.

41. MILES, H. S. The errors of refraction found in four thousand eyes. *The Refractionist*, Oct., 1894.

42. HOWE. Note on lid pressure as a cause of astigmatism. *Amer. Journ. of Ophth.*, Sept., 1894.

43. THEOBALD. Some typical cases of subnormal accommodative power. *Trans. Amer. Ophth. Soc.*, 1894.

44. WHITE, J. A. The practical value of low-grade cylinders in some cases of asthenopia. *Ibid.*, 1894.

NIEBUHR (38) reports eighteen operations for myopia done in the clinic at Halle. Discission was first done, then the opaque lens extracted by the linear method, and finally the posterior capsule divided. In only three cases was the swelling of the lens accompanied by irritation or pressure symptoms; with the extraction there was prolapse of iris three times, loss of vitreous twice, and hemorrhage into the anterior chamber once. In one case eczema of the lid margin and injection of the conjunctiva developed under the bandage, followed by iritis and hypopyon. The eye was lost in another case from infection of the cornea due to a croupous conjunctivitis. The difference in refraction was 18 D on an average, all the eyes being finally hyperopic. The acuteness of vision was increased in all but three cases.

Of 720 hyperopes with poor vision that CHAUVEL (39) examined 53. 4% had poor sight in both eyes; 21. 2 % in the right only; and 15. 4 % in the left only. No more than half the number had an equal amount of hyperopia in the two eyes. All the individuals examined had vision below the French military standard, which is $\frac{1}{2}$ for one eye and $\frac{1}{10}$ for the other. Careful investigation was made as to the cause of the poor vision. Examinations with

the stenopaic slit showed that the refraction *per se* played only a minor rôle. Frequently there were anomalies of the field of vision, mostly a more or less marked concentric contraction usually proportional to the amblyopia. Notwithstanding the great number of hyperopes with poor vision that he examined, Chauvel could find no cause for the poor vision. SULZER.

RAIA (40) discusses asthenopia due to errors of refraction and particularly that due to strain of the recti muscles. He believes with Stevens that difficulty in performing abduction and vertical movements causes reflex asthenopia more frequently than insufficiency of the interni. Exercise, prisms, and tenotomy are recommended in the way of treatment. DANTONE.

In the 4000 eyes reported on by MILES (41), 76 per cent., or 3045, were H., and of those 2384 were simple H., 442 were simple astig. H., and 219 were H. with H. astig. There were 787 M., of which 454 were simple, 182 simple M. astig. and 151 compound M. astig. There were 106 cases of mixed astig. Of the whole number 67½ per cent. were females and the ages ranged from two to eighty years. There were sixteen cases of anerometropia. BURNETT.

HOWE (42) has demonstrated on *himself* and others the fact that corneal astigmatism can be produced by persistent, strong lid pressure—and has found, in thirty-three *artists* who habitually make the lid pressure in "half-shutting" the eyes at their work, an average astigmatism of .905 D. BURNETT.

THEOBALD (43) reports four additional cases of "subnormal accommodative power," whose chief characteristic is that with an orthophoric condition of the ocular muscles at a distance there is not an exophoria of 3° to 5° for the working distance as should exist when the accommodation is normal. BURNETT.

WHITE (44) has learned from his experience the value of low-grade cylinders as low as 0.25 D in relieving asthenopia, particularly when the axis was off the perpendicular or horizonal or there was anerometropia. One hundred cases are tabulated. BURNETT.

VII.—LIDS.

45. LANDWEHR. On the etiology of chalazion. *Ziegler's Beitr. z. path. Anat. und z. allgem. Pathol.*, xvi., 2, p. 255.

46. MIBELLI. Blepharitis trichophytica. *Ann. di Ottalm.*, xxiii., 5, p. 368.

47. SNELL. Congenital cysts of the eyelids associated with anophthalmus or microphthalmus. *Trans. Ophth. Soc. Un. K.*, xiv., p. 180.

48. DE BOURGON. Unilateral œdema of the lid, the first symptom of a generalized multiform exudative erythema. *Ann. d'Ocul.*, cxii., p. 316.

49. OHLSTRÖM. Congenital bilateral ptosis and immobility of the eyeballs. *Beiträge z. Augenheilk.*, xvi., p. 43.

50. DE SCHWEINITZ. Epithelioma simulating ulcerated Meibomian cyst. *Trans. Amer. Ophthal. Soc.*, 1894.

51. WILMER. A case of melanotic giant-cell alveolar myxoma-sarcoma. *Ibid.*, 1894.

In order to determine whether chalazion has a tuberculous basis, LANDWEHR (45) inoculated the contents of seven chalazia into animals. In no case did tuberculosis develop. Since, however, various observers have found tubercle bacilli in chalazia, we may conclude that only in a small number of cases is the chalazion a tuberculous product, while in the majority it is not.

MIBELLI (46) describes two cases of severe inflammation of the margin of the lid, accompanying trichophytosis on the face, scalp, and neck. Spores of trichophyton were found on the lashes that were pulled out, and the author therefore considers himself justified in calling the disease blepharitis trichophytica. Epilation and antiseptic treatment brought about a cure. DANTONE.

SNELL (47) reports three cases of congenital cysts, two occurring on the lower lid and being associated with anophthalmus, one on the upper lid, associated with microphthalmus. In the latter case there was vomiting when the cyst was punctured. It pulsated synchronously with the anterior fontanelle. Chemical examination of the fluid showed that it was not cerebro-spinal fluid. All three cases were cured, the first two by removing a part of the cyst and the third after three punctures. WERNER.

OHLSTRÖM (49) observed a congenital bilateral ptosis and almost complete immobility of the ball in a boy of fifteen. The accommodation was normal.

DE SCHWEINITZ (50) found a large granular mass protruding from what appeared to be a chalazion of the upper lid. This was excised and the cavity curetted. On examination of the mass it was found to be of an epitheliomatous character. BURNETT.

WILMER'S (51) case was a woman of thirty years who had

a growth on the right lower lid which grew very rapidly in size. There was no history of any injury. The conjunctiva was normal. It was removed and measured 12 x 7 *mm* after hardening in alcohol. It had not returned after a year or more had elapsed. It was found to be a melanotic giant-celled myxo-sarcoma. BURNETT.

VIII.—LACHRYMAL APPARATUS.

52. OHLSTRÖM. On extirpation of the tear sac. *Eira*, No. 16, 1894.

53. DE BONO and ALAIMO-MARCHETTI. Iodine injections in the treatment of chronic dacryocystitis. *Arch. di Ottalm.*, ii., 6. p. 195.

54. BAQUIS. Trachoma of the lachrymal gland. xxiii., 3–4, p. 227.

55. SULZER. A contribution to the study of tuberculosis of the lachrymal gland. *Graefe's Archiv*, xl., 5, p. 197.

56. LEPLAT. A case in which death followed probing and injecting the lachrymal canal. *Ann. d'Ocul.*, cxii., p. 328.

OHLSTRÖM (52) gives the following indications for extirpation of the lachrymal sac: 1. Before operations on the ball, when there is not sufficient time for other modes of treatment. 2. When conservative treatment is unsuccessful. 3. In ectasia of the sac, even when the canal is pervious. 4. In tuberculosis of the sac. 5. In obliteration of the canal. 6. With fistula of the sac which resists other forms of treatment. SCHIÖTZ.

53. DE BONO and ALAIMO-MARCHETTI have used with good results injections of iodine in cases of old lachrymal-sac disease, and particularly in those with ectasia of the sac (iodine 0.50, iodide of potassium, 5.00, water 50.00). Care should be taken not to allow the fluid to enter the conjunctival sac. DANTONE.

BAQUIS (54) gives a detailed clinical and histological description of two tumors of the lachrymal gland, removed from a patient having trachoma. From microscopical examination the author makes the diagnosis of trachomatous formation in the lachrymal gland. DANTONE.

SULZER (55) reports a further case of tuberculosis of the lachrymal gland. The gland was removed from a girl of fifteen of tuberculous antecedents.

LEPLAT'S (36) patient suffered from a chronic purulent dacryo-

cystitis which was not improved by injections. A Bowman No. 2 probe was passed easily through the upper two-thirds of the duct, and after this an injection of water was made followed by an injection of 3 % alum solution, which did not pass into the nose. There was no reaction. The following day the procedure was repeated, the alum solution then passing into the naso-pharynx. Shortly after a brown spot was noticed near the lachrymal sac, and the following day the patient showed symptoms of a phlegmon of the face, which grew smaller the second and third day. On the fourth day there was still slight swelling of the sac. The patient complained of pain in the legs. Sudden vomiting. Toward evening, Cheyne-Stokes respiration. Loss of consciousness. T. 39.1. Death two days later. SULZER.

IX.—MUSCLES AND NERVES.

57. SCHWEIGGER. The results of squint operations. *Arch. f. Augenh.*, xxix., p. 165.

58. JOUCK. The various methods of performing squint operations. *Inaug. Dissert.*, Strassburg, 1894.

59. STEVENS. The importance of maintaining the relative amplitude of rotation of the two eyes in operations on the ocular muscles. *Ann. d'Ocul.*, cxii., p. 289.

60. VOSSIUS. A case of traumatic ophthalmoplegia resulting in recovery. *Beiträge zur Augenheilk.*, xvi., p. 34.

61. FRIEDENWALD, N. Traumatic paralysis of the abducens nerve. These ARCHIVES, xxiii., p. 403.

62. HALE, G. W. So-called muscular asthenopia. *Trans. Amer. Ophth. Soc.*, 1894.

According to SCHWEIGGER'S (57) experience, in cases of convergent strabismus with normal binocular vision, the final result of tenotomy of the squinting eye is not sufficient. In periodic squint without diplopia a simple tenotomy should first be done, and if the effect is not sufficient an operation can be done on the other eye. A simple tenotomy in a permanent squint is sufficient only when the average deviation is not over 4 *mm*. A deviation of 5 *mm* can be corrected by tenotomy of both interni, a greater deviation requires advancement. A tenotomy of the externus is successful only in periodic divergent squint. If a squint develops at an age when normal binocular vision has become a habit,

diplopia can usually be made out, and the operation restores binocular vision. Usually, however, squint appears at an age when binocular single vision has not become a fixed physiological habit, and even when the operation brings the eyes into such position that normal binocular fusion is possible, it is often not learned.

After describing two cases of traumatic paralysis of the abducens which were operated on with success, JOUCK (58) gives an historical sketch of the squint operation and a description of the different methods of its performance.

In a boy of seventeen, who had received an injury on the left lower lid, VOSSIUS (60) found an almost complete paralysis of all the extrinsic and intrinsic muscles of both sides, and poor vision, all of which was finally completely recovered from. The affection was probably caused by a hemorrhage compressing the nerves of the ocular muscles and the optic nerves.

FRIEDENWALD'S (61) paper forms a continuation of Purtscher's article published in these ARCHIVES. Ten cases in this catagory are noted, and a remarkable case, seen by the author, is added. A man's head was compressed between two railway cars, the force acting transversely on the two parietal bones. Gradually there developed a complete bilateral paralysis of the abducens. That of the left side disappeared in six weeks, while that of the right lasted somewhat longer. There was probably a fracture of the base passing transversely through both temporal bones.

GREEFF.

HALE (62) believes that muscular asthenopia usually has its seat in the central organs, depending upon a disturbance of innervation, or, possibly, in some cases upon a weakness of the power of fusion. In a small per cent. it depends upon the absolute or relative weakness of the adductors or the obliques, or upon their insertion. He depends in treatment entirely upon gymnastic exercise with prisms. BURNETT.

X.—ORBIT AND NEIGHBORING CAVITIES.

63. MITVALSKY. Studies on the osseous tumors of the orbital region. *Arch. d'opht.*, xiv., 10, p. 593.

64. RABINOWITSCH. Echinococcus of the orbit. *Centralbl. f. prakt. Augenh.*, 1894, p. 359.

65. RAUSCHKE, MAX. Two cases of inflammatory exophthalmus with fatal ending. *Inaug. Dissert.*, Berlin, 1894.

66. BÉCLÈRC. On thyroidism and its relations to Basedow's disease and hysteria. *Soc. méd. des hopitaux*, Oct., 1894.

67. CLARK, E. Impairment of consensual downward movement in right eyelid, with retraction of the lid, and frequent winking in commencing Graves' disease. *Trans. Ophth. Soc. Un. K.*, xiv., p. 244.

68. HERSKIND. On the surgical treatment and pathogenesis of Basedow's disease. *Bibliotek f. Legar.*, 1894, iv., p. 204.

69. HJORT. Transplantation of skin into the orbit. Norsk, *Mag. f. Laeger.*, No. 7, 1894.

70. HARLAN. Three cases of malignant tumor of the orbit. *Trans. Amer. Ophth. Soc.*, 1894.

71. JOHNSON, W. B. Foreign bodies in the orbital cavity. *Ibid.*, 1894.

MITVALSKY (63) describes the clinical picture and the genesis of osteoma of the frontal sinus with disease of the mucous membrane, leading to retention of contents, distension of the cavity, formation of polypi, and mucous cysts in the tumor and in the orbit, and after suppuration of the cysts, to the formation of fistulæ. His first case was in a girl of fourteen, in whom, after a contusion, there developed a tumor filling the frontal sinus, thinning the anterior layer of the frontal bone, breaking through the inner wall of the orbit, and forming a cyst in the latter. No operation was made at first except the emptying of the cyst, as the ethmoid cells were involved. But when the tumor increased in size, cerebral symptoms being absent, a second operation was undertaken, and an osteoma the size of a fist was removed. After the operation there were wanting the entire cribriform plate of the ethmoid, the lachrymal bone, two-thirds of the upper wall of the orbit, and the entire middle portion of the frontal bone. The tearing away of a portion of the dura adherent to the tumor left the brain bare. Although the nasal cavity communicated with the operative cavity, there was complete recovery with preservation of the eye and its functions. The removal of a small recurring tumor led to permanent recovery. The tumor, weighing 180. gr., of ivory hardness, showed many cavities containing mucous polypi.

In the second case, due to trauma, in a man of thirty, the osteoma, as was seen after its removal, involved the inner two-thirds of the

entire roof of the orbit back to the optic foramen. A centimetre from the orbital margin was a polyp of hazel-nut size. A resection was made, after which the growth ceased to increase, and the eye regained its normal position and functions.

The author does not regard the prognosis as being so bad as it was formerly thought to be.

He further reports a case of exostosis of the left orbit in a woman of sixty-five, occupying the entire upper and inner orbital wall, while an ecchondroma sprang from the outer thickened orbital wall, and involved the external rectus. The eyeball was enucleated, but the exostosis could not be removed, and the outcome of the case was unknown. Since the ecchondroma was separated from the exostosis by a layer of periosteum and muscle sheath, the development of the latter from the former was excluded. v. MITTELSTÄDT.

In a girl of seventeen, RABINOWITSCH (64) observed a very rapid development of a left exophthalmus. Outward from and below the protruding ball a tumor could be felt. This was removed with preservation of the ball and proved to be an echinococcus.

RAUSCHKE (65) reports a case of orbital phlegmon in a girl of thirteen, following extraction of a tooth, and one in a man of forty-four, following an abscess in the upper jaw, both having a fatal issue.

HERSKIND (68) gives notes of 42 cases of Basedow's disease from various sources, which were treated by strumectomy or ligature of the thyroid artery, and finds that in 40 % of cases the chief symptoms disappeared completely. SCHIÖTZ.

In two cases of exenteration of the orbit with removal of the entire periorbita and both eyelids, and in a case in which both eyelids, conjunctiva, and ball were removed, HJORT (69) waited until a smooth granulating surface was obtained and then transplanted Thiersch flaps with excellent result. SCHIÖTZ.

70. Case 1.—Epithelial growth evidently beginning in the lachrymal sac in a man of forty years. It was removed, but recurred in three months. Case 2.—Sarcoma, completely filling the orbit, which seemed to start from Tenon's capsule. The eyeball was greatly compressed, but the sclera was sound. Case 3.—Sarcoma of orbit in a child of nine years. It was removed but rapidly recurred and attained a size half as large as the patient's head. Patient died. BURNETT.

All the cases related by JOHNSON (71) were successfully treated except one, which ended fatally from a meningitis caused by a perforation of the anterior lobe of the cerebrum. The size of another would lead to the suspicion that it also had penetrated the brain, but no outward symptoms developed. The histories of four cases in all are reported, and most of the bodies were large. The first was a large twig of cherry tree ; another a piece of pine plank (this penetrated the brain). The third was a piece of pine wood, and in the fourth a mass of grass and bit of weed. In the last case the foreign body struck the back of the eye and produced hemorrhages of the choroid which threatened panophthalmitis, but the eye was finally saved. BURNETT.

XI.—CONJUNCTIVA, CORNEA, SCLERA, AND ANTERIOR CHAMBER.

72. KALT. Treatment of ophthalmia neonatorum. *Arch. d'opht.*, xiv., 12, p. 780.

73. ROHMER. Note on ophthalmia neonatorum. *Annal. d'Ocul.*, cxii., p. 373.

74. PARINAUD. Lachrymal conjunctivitis in the new-born-due to the pneumococcus. *Ibid.*, p. 369.

75. SCHANZ. On the etiology of diphtheria. *Deutsche med. Wochenschr.*, 1894, No. 49.

76. SCHIRMER. The clinical picture of conjunctivitis due to the diphtheria bacillus. *Graefe's Archiv*, xl., 5, p. 160.

77. COPPEZ. A case of ocular diphtheria cured by serotherapy. *Annal. d'Ocul.*, cxii., p. 341.

78. HELLGREN. On the mechanical and operative treatment of trachoma. *Hygiea*, 94, 12, p. 569.

79. ANDOGSKY. The operative treatment of xerosis of the eye. *Wratsch*, 1894, No. 43.

80. VAN DUYSE. Two cases of hyaline degeneration of the conjunctiva. *Arch. d'opht.*, xvi., 12, p. 742.

81. LAGRANGE and MAZET. Epithelioma of the bulbar conjunctiva and its propagation into the eyeball. *Ibid.*, p. 768.

82. SANLAY. Note on conjunctival papilloma. *Rec. d'opht.*, 1894, No. 9, p. 543.

83. GASPARINI. Another successful case of transplantation of skin in a case of symblepharon. *Ann. di Ottal.*, xxiii., 34, p. 281.

84. JUDA. Subconjunctival cysticercus. *Med. Weekblad.*, 1894.

85. BOCCHI. On the recurrence of pterygium. *Arch. di Ottal.*, ii., 3–4, p. 120.

KALT (72) believes that careful cleansing and disinfection of the conjunctival sac are all that is necessary in the treatment of blennorrhœa. He places a funnel of ebony between the lids, and through a tube connected with it two quarts of solution of permanganate of potassium are passed into the conjunctival sac twice daily or oftener. V. MITTELSTÄDT.

ROHMER (73) reports several cases which suggest facts in the nosology and therapy of ophthalmia neonatorum that are too often forgotten. At times severe cases recover without treatment, at others the cornea is perforated in spite of the most careful treatment. SULZER.

PARINAUD (74) calls attention to the fact that obstetricians and midwives often see a benign but tedious conjunctival inflammation of the new-born that is rarely observed by the oculist. In most of these cases there is obstruction in the lachrymal duct, and there is rhinitis present. The affection is usually cured in three or four weeks with the use of boric acid washes, or even without treatment. The pneumococcus is found in the secretion in every case, the gonococcus and Weeks' bacillus never. SULZER.

From the study of a case of infantile xerosis with keratomalacia, SCHANZ (75) concludes that the xerosis bacillus is a Löffler's diphtheria bacillus of diminished virulence.

In 8 cases of croupous conjunctivitis SCHIRMER (76) found the Löffler bacillus always present.

COPPEZ (77) believes that injections of antitoxin exert a favorable influence on diphtheritic conjunctivitis. In one case, in a girl of twelve, in which the local use of oleum cadini did not affect a diphtheritic conjunctivitis with an adherent membrane, a single injection caused a rapid improvement and the dissolution of the diphtheritic exudation. Bacteriological examination revealed many diphtheria bacilli and a few streptococci. SULZER.

Of the various mechanical and operative methods of treatment, HELLGREN (78) prefers expression. He reports 42 cases operated on in this way. He frequently used Knapp's roller-forceps with smooth rollers. The results were good on the whole although keratitis developed after the operation in 4 cases, and in one lasted a long time and reduced vision to $\frac{1}{2}$.

(Corneal ulcerations, which are mentioned by several authors and which I have never met with, probably have occurred in cases of trachoma complicated with an infective conjunctivitis. Smooth cylinders, in my experience, have been less efficient than creased ones.—H. K.)

AUDOGSKY (79) operated on 5 eyes of 13 patients with trachomatous xerophthalmus after Rudin's method, which consists in a narrowing of the palpebeal fissure, with the expectation that by diminishing the extent of the uncovered dry surface, the secretion from the surface and glands of the conjunctiva will be more apt to keep the cornea moist. HIRSCHMANN.

LAGRANGE (81) describes another case of epithelioma observed with MAZET. The tumor, having the size of a franc piece, occupied the inner-upper sclero-corneal region of the right eye of a woman of sixty-five, and extended inward in a cone-shaped process between the ciliary body and the sclera. v. MITTELSTÄDT.

GASPARINI (83) reports the successful transplantation of two flaps of skin from the forearm to cure a symblepharon. The scar of the latter, which followed the removal of an epithelioma, extended to the corneal margin and had caused glaucoma. The pain demanded operative interference.

The operation not only restored the mobility of the ball, but led to complete disappearance of the glaucomatous symptoms and to the recovery of useful vision. DANTONE.

JUDA (84) removed a cysticercus from beneath the conjunctiva of a child of six. WESTHOFF.

BOCCHI (85) describes the histological process that takes place in the recurrence of pterygium. This is more frequent when the entire pterygium is removed and the wound cauterized, than when the removal is only partial and the conjunctiva is sutured.

DANTONE.

86. BJERRUM. Subconjunctival injections. *Med. Aarsskrift*, 1894.

87. SANTO DOMINGO. On congenital opacity of the cornea. *Inaug. Dissert.*, Berlin, 1894.

88. SNELLEN. Epithelioma of the cornea. *Med. Weekblad.*, 1894.

89. DE WECKER. Treatment of injuries of the cornea by occlusion with conjunctiva. *Annal. d'Ocul.*, cxii., p. 293.

90. KYLE. A case of gumma of the sclerotic. *Amer. Journ. of Ophth.*, Nov., 1894.

BJERRUM (86) reports an obstinate case of kerato-iritis treated without result, in which 3 subconjunctival injections of a solution of salicylate of soda cured the disease completely. He had often used this remedy and believed that he had seen favorable results while he had not seen results from the injection of sublimate.

SCHIÖTZ.

SNELLEN (88) reports a case in which an epithelioma of the cornea developed after a pterygium had been removed twice. The ball was enucleated. WESTHOFF.

DE WECKER (89) in cases of corneal injury advises covering the entire cornea with a conjunctival flap. The conjunctiva is loosened about the cornea, as in the abscission of staphyloma, and drawn together over the cornea by a tobacco-pouch suture or by four to six sutures applied in a vertical line. SULZER.

The case which KYLE (90) reports is evidently one of what is known as gumma of the ciliary body, in a man of twenty-two, who had the initial lesion of syphilis sixteen months before.

BURNETT.

Sections XII.–XXI. Reviewed by DR. P. SILEX.

XII.—IRIS.

91. PFAMMÜLLER. A contribution to the colobomas of the eye. *Inaug. Dissert.*, Giessen, 1894.

92. MOEGELE. On iritis with nodular formations. *Inaug. Dissert.*, Tübingen.

93. MALGAT. Spontaneous mydriasis. Recovery after strychnine injections. *Rec. d'opht.*, 1894, p. 714.

94. HOWE, L. Three cases of so-called ectropion uveæ. *Trans. Amer. Ophth. Soc.*

95. OLIVER. Some additional studies upon the clinical value of repeated careful correction of manifest refractive errors in plastic iritis. *Ibid.*, 1894.

96. DE BECK. A family history of irideremia and coloboma. Cataract operation on two members. *Ibid.*, 1894.

PFAMMÜLLER (91) reports on 16 patients with 18 colobomatous

eyes, seen in Giessen in the last four years. There were 3 colobomas of the optic nerve, 1 of the macula, 1 of the lens, 10 of the iris, and 10 of the lids. The various theories as to the origin of coloboma are discussed.

MOEGELE (92) believes that two of his cases of iritis serosa with grayish-red and white nodules in the iris are identical with those described by Liebrecht and Vossius, and called by the latter iritis with nodular new formations resembling tubercles. Tuberculosis could be ruled out.

MALGAT'S (93) patient, a healthy woman of fifty, after great excitement, had an attack of headache lasting through the night. The following day the sight of the left eye was affected. Ten days after, the left pupil was dilated ad maximum, the eye being otherwise normal. Injections of strychnine twice a week cured the affection in a month. SULZER.

HOWE (94) reports three cases of pigmentary excrescences projecting from the edge of the pupil into the anterior chamber, some of which are pedunculated. In two there was myopia of high degree. He thinks all such cases should be classed under papillomata iridis. BURNETT.

By a number of carefully conducted experiments OLIVER (95) has shown that the so-called "spastic accommodation" in plastic iritis is not due to a forward displacement of the lens nor to increase in the aqueous or vitreous humors. BURNETT.

DE BECK'S (96) cases were in two brothers who were affected with double cataract, the one with irideremia and the other with a downward coloboma of the iris. The former was forty-two years old, the latter thirty-six, and vision had never been good in either case. The cataracts had been developing for two or three years. The four cataracts were extracted, but there was excessive reaction in all—and one fairly good eye was saved for each one. The author infers that in these cases of anomalies of the uveal tract there is a liability to serious reaction after operations. In regard to these defects, it is interesting to note that in the first generation there were two brothers, one with irideremia and the other with coloboma; in the second generation the brother with irideremia has one son with irideremia and another with coloboma, while the brother with coloboma has a son with irideremia; in the third generation the son with irideremia has three children (sons) with irideremia; the son with coloboma has a daughter with irideremia. BURNETT.

XIII.—CHOROID.

97. GINSBERG. Exudative choroiditis and multiple pedunculated polypoid granulation-tumors of the choroid as pseudoglioma. *Centralbl. f. Augenheilk.*, xviii., p. 322.

98. WIEGMANN. A case of choroiditis senilis maculata. *Klin. Monatsbl. f. Augenheilk.*, xxxii., p. 457.

99. FAGE. Rupture of the choroid. *Soc. d'opht. de Paris*, Nov. 6, 1894.

100. TERSON. Early gummata of the ciliary body. *Arch. génér. de méd.*, Oct., 1894.

101. BERGER. Colloid degeneration of the endothelium of the posterior chamber. *Arch. d'opht.*, xiv., 2, p. 677.

102. THEOBALD. A case of panophthalmitis suppurativa following discission of a capsular opacity. *Trans. Amer. Ophth. Soc.*, 1894.

103. DE SCHWEINITZ. Colloid disease in the macular region analogous in appearance to the so-called disease in the nerve head. *Trans. Amer. Ophth. Soc.*, 1894.

In GINSBERG'S (97) case, the eye showed the clinical picture of glioma and was enucleated. Microscopically there was found an exudative choroiditis which had led to detachment of the retina and atrophy of the choroid, with great proliferation of the pigment epithelium, and had produced a multiple pedunculated tumor arising from the choroid and projecting free into the interior of the ball. There was no history of syphilis. Granulation tumors have been described by Leber, Wedl-Bock, and Pagenstecher-Genth.

TERSON (100) calls attention to the fact that a gumma of the ciliary body coming on in the course of a specific granuloma iritis is easily diagnosticated, while a primary early gumma of the ciliary body is usually mistaken for neoplasm and the eye enucleated. Primary gumma of the ciliary body is often an early tertiary manifestation of syphilis. In the beginning the symptoms are not characteristic, being pain and diminution of vision. Following this latent period comes swelling of the sclera in the ciliary region, and later the iris becomes infiltrated, and cauliform excrescences form at its base, the latter symptom by itself justifying a positive diagnosis. SULZER.

BERGER'S (101) case was one of benign tuberculosis of the

uveal tract. He found a thickening of the membrana limitans iridis and at points a swelling of the pigment epithelium which was separated from the membrana limitans by a layer of fluid, and also showed cavities filled with fluid, among the cells. On the posterior surface of the membrana limitans were numerous hemispherical, homogeneous, yellow formations having the size and histological characteristics of hyaloid formations on the membrane of Descemet. There were also many of the colloid balls in the anterior chamber. Similar changes were found in the endothelium on the lamina vitrea of the pars ciliaris retinæ in an eye with iridocyclitis, and in an atrophied ball with preservation of the anterior chamber. The author believes that the endothelium of the posterior surface of the iris has the same significance as that of Descemet's membrane and the cells of the anterior capsule of the lens, and that a disturbance in these cells may also lead to nutritive disturbances in the neighborhood.

V. MITTELSTÄDT.

THEOBALD'S (102) patient was a negro boy of fourteen years, on whom he had operated several times on both eyes for cataract by discission. To remove a remaining capsular opacity in the right he needled it after the usual aseptic precautions. In seventy-four hours the cornea was necrotic and the ball went on to atrophy. —Knapp said in the discussion that in more than 1500 discissions for secondary cataract he had not had a single case of that kind.

BURNETT.

DE SCHWEINITZ (103) reports two cases with a fine chromolithograph of colloid degeneration at the macula of both eyes—with unimpaired vision. BURNETT.

XIV.—GLAUCOMA.

104. ANGELUCCI. On disturbances in the vascular apparatus that are met with in patients with hydrophthalmus congenital or acquired. *Arch. di Ottal.*, ii., 1–2. p. 24.

105. OLIVER. A clinical and microscopical study of two cases of glaucoma associated with intraocular hemorrhages. *Trans. Amer. Ophth. Soc.*, 1894.

ANGELUCCI (104) is led by experiment to believe that hydrophthalmus is caused by vaso-motor changes in the uveal tract, which in their turn are to be referred to disturbances in conduction in the region of the trigeminus and cervical sympathetic.

Under these trophic influences, damage is done to the choroid, iris, and cornea while the retina does not suffer. DANTONE.

These two cases, whose history OLIVER (105) has followed out serve to illustrate the two opposite issues that may occur in glaucoma which seems to be secondary to retinal hemorrhages. In one the eye went on to destruction, in the other some vision was saved, even though a lens which had become cataractous had to be extracted. Iridectomy was done in both cases. In the first (unsuccessful) case, there was a perivasculitis associated with grave central nervous disease. In the other there is a probability that the vascular walls were not so much diseased, and the author agrees that there may be still hope for cases of glaucoma following hemorrhage under proper hygienic care. BURNETT.

XV.—SYMPATHETIC OPHTHALMIA.

106. BJERRUM. On the pathogenesis of sympathetic ophthalmia. *Med. Aarsskrift*, Copenhagen, 1894.

107. LANG. Sympathetic inflammation beginning ten days after a penetrating wound just behind the sclero-corneal junction. *Trans. Ophth. Soc. Un. K.*, xiv., p. 218.

108. HOBBY. Are gun-cap wounds of the eye without danger? *Annals of Ophth. and Otol.*, Oct., 1894.

HOBBY's (108) experience has been that fragments of percussion caps (copper) are liable to produce sympathetic ophthalmia, especially when the wound is in the ciliary region. He gives five cases in support of this, and says that there are twenty cases in the College for the Blind in Iowa who lost the second eye from sympathy with the other, which had been wounded by a fragment of percussion cap. BURNETT.

XVI.—LENS.

109. KNAPP. On glaucoma after discission and its treatment. *Arch. f. Augenheilk.*, xxx., p. 1.

110. STEPHENSON. Coloboma of each lens. *Trans. Ophth. Soc. Unit. King.*, xiv., p. 211.

111. CHRISTEN. Three cases of congenital coloboma of the lens. *Arch. f. Augenheilk.*, xxix., p. 233.

112. PAGENSTECHER. Practical points in cataract extraction. *Klin. Monatsbl. f. Augenheilk.*, xxxii., p. 439.

113. SNELL. Case presenting unusual appearances after extraction of cataract; simulating a cyst, really due to a distended capsule. *Trans. Ophth. Soc. Unit. King.*, xiv., p. 135.

114. KALT. Corneal suture after extraction of cataract. These ARCHIVES and *Arch. d'opht.*, xiv., p. 10.

115. CLARK, C. F. A case of binocular coloboma of the lens with accommodative power retained. *Trans. Amer. Ophth. Soc.*, 1894.

Altogether, KNAPP (109) has seen 15 more or less severe attacks of glaucoma follow discission of secondary cataract. These attacks came on particularly after extensive splitting of the capsule and deep penetration of the knife into the vitreous, and also when considerable masses of cortex had been left. Yet probably the swelling is not so much the cause of the glaucoma as is traction on the ciliary processes. This traumatic glaucoma may be cured spontaneously, or it may lead to blindness. Some cases recover through the use of eserine and hypodermic injections of morphine, while others require iridectomy. Posterior sclerotomy had not been successful; anterior sclerotomy had not been tried. (The reviewer cured two cases of this sort permanently by puncturing the anterior chamber.)

CHRISTEN (111) describes 5 congenital colobomas of the lens seen in 3 patients, only 46 cases in 38 individuals having been previously reported. The affection is usually bilateral. Four times the coloboma was downward, once upward and outward. In 2 instances the capsule was normal notwithstanding the defect in the lens, which speaks for the independent development of lens and lens capsule. There was also coloboma of the iris in 4 of the eyes. Vision was fair in 4 and poor in 1 eye.

PAGENSTECHER (112) advises beginning operators not to be led astray and confused by the new modifications suggested every day in the extraction of cataract, but says that they should choose one operation and become proficient in it. The beginner should do the operation with iridectomy, and discission should be done with a thin conical needle passed through the sclero-corneal margin.

In SNELL'S (113) case the lens was extracted, some vitreous escaping. V = $\frac{6}{9}$. Six or seven years later the patient noticed a small white body in the anterior chamber. There was a pear-shaped cyst in the lower part of the eye connected by a thin

thread with the iris, and this cyst proved to be formed of lens capsule. WERNER.

CLARK (115) describes a case where there was a defect in both lenses below the edge, forming a horizontal line. The eyes were myopic, but possessed good accommodation, and the total astigmatism was much less than the corneal when the eye was not under the influence of a mydriatic, but was nearly the same when it was atropinized. BURNETT.

XVII.—VITREOUS.

116. PRESSEL. A case of recurrent hemorrhage into the vitreous in consequence of menstrual disturbances. *Inaug. Dissert.*, Würzburg, 1894.

117. v. HIPPEL, E. On recurrent intraocular hemorrhages caused by a tumor. *Graefe's Archiv*, xl., 4, p. 260.

118. BATTEN. Persistent hyaloid artery branching in the vitreous. *Trans. Ophth. Soc. Unit. King.*, xiv., p. 209.

PRESSEL (116) reports a case of hemorrhage into the vitreous occurring fifteen times within a few months in a girl of sixteen who had never menstruated. It was supposed that the hemorrhages were due to an hereditary specific vascular affection which caused the terminal arteries to become brittle.

v. HIPPEL (117) reports two cases of recurrent intraocular hemorrhage due to a tumor. The anterior chamber became filled with connective tissue, and there were marked inflammatory changes in the interior of the eye. The ball did not perforate. From the fibrin of the blood there had formed a homogeneous, colloid-like substance that gave the characteristic reaction for amyloid.

XVIII.—RETINA AND FUNCTIONAL DISTURBANCES.

119. GUIFINKEL. A case of spontaneous cure of detachment of the retina. *Wjest. Ophth.*, No. 6, 1894.

120. UHTHOFF. Demonstration of a case of reattachment of the retina, and a case of tuberculosis of the upper lid. *Berliner klin. Wochenschr.*, No. 31, 1894.

121. SCHEFFELS. Cure of myopic detachment of the retina. *Festschr. z. 50-jähr. Jubiläums d. Vereins d. Aerzte d. Reg. Bez. Düsseldorf*, p. 280. Bergmann, Wiesbaden, 1894.

122. TSCHMEMOLASSOW. Hemorrhage in the retina in pernicious anæmia, due to tapeworm. *Petersb. med. Wochenschr.*, 1894, p. 50.

123. CRAMER and SCHULTZE. On pseudo-glioma of the retina. *Arch. f. Augenheilk.*, xxix., p. 288.

124. BERGER. Syphilitic retinitis with albuminuria. *Rev. génér. d'opht.*, xiii., p. 490.

125. KATAYAMA and OKAMOTO. Studies on amaurosis and amblyopia, caused by the malefern. *Vierteljahresschr. f. gerichtl. Med. u. öffentl. Sanitätswesen*, 1894, suppl.

126. DE HAAS. On epidemic hemeralopia. *Tydschr. voor Geneeskunde*, ii., p. 999, 1894.

127. SIMON. On the origin of the so-called fatigue contraction of the visual field. *Graefe's Archiv*, xl., 4, p. 276.

128. BOUVIN. Embolism of the central artery of the retina. *Med. Weekblad*, 1894.

129. WAGENMANN. Disappearance of medullated nerve fibres in the retina in consequence of tabic optic-nerve atrophy. *Graefe's Archiv*, xv., 4, p. 257.

130. BULL. Recent experiences in the treatment of detached retina, with a detailed report of thirty-eight cases. *Trans. Amer. Oph. Soc.*, 1894.

131. WURDEMANN. Report of a case of thrombo-phlebitis of the central retinal vessels, with necropsy. These ARCHIVES, xxiii., p. 445.

132. DE SCHWEINITZ. Concerning monocular diplopia, with cases. *Ibid.*, 1894.

133. HEYL. Rupture of the lymph sheath of a retinal vein. *Ibid.*, 1894.

In GUIFINKEL'S (119) case there was detachment of the retina in an eye, with myopia, sclerectasia, and atrophic changes in the fundus, on which an iridectomy had been done for exclusion of the pupil. Treatment was of no benefit, but eight months later the retina had become spontaneously reattached, with restoration of the previous vision, and in three years there has been no change. HIRSCHMANN.

SCHEFFEL'S (121) patient with detachment of the retina was cured in nine months by rest in bed and alterative and diaphoretic treatment. Cases treated by Schöler's method did not do well.

Pagenstecher in one case made multiple punctures through sclera, choroid, and retina, in the hope of exciting an adhesive chorio-retinitis, and obtained a permanent result.

TSCHMEMOLASSOW (122) gives a preliminary report on four cases of pernicious anæmia, caused by the bothriocephalus latus, that were speedily cured by removal of the parasite. In all four cases there was retinal hemorrhage, varying in size from the punctate to such as were as large as the disc. These hemorrhages are due to the anæmia, and not to the parasite directly.

CRAMER aud SCHULTZE (123) give a clinical and anatomical description of a case of pseudo-glioma in a girl of fifteen. The clinical picture was that of glioma, excepting the age of the patient. The symptoms diagnostic of pseudo-glioma were mostly wanting. The enucleated ball was 18–19 *mm* in all diameters. The retina was totally detached, and the vitreous chamber was filled with a whitish exudation. The ciliary body was atrophic. There was diffuse fibrous degeneration of the entire choroid with fresh inflammatory foci, and near the optic nerve numerous pigmented spots with giant-cells, such as are found about foreign bodies, and cholesterin crystals. Pseudo-glioma is only a negative diagnosis, glioma being mostly confounded with purulent choroiditis, due to infectious diseases, and particularly often, in the opinion of the authors, to measles.

A patient, who had taken 3.00 of malefern daily for twelve days for anchylostomum duodenale, led KATAYAMA and OKAMOTO (125) to study the toxic effect of this drug on vision. The amblyopia, like tobacco amblyopia, seems to affect the weak and anæmic most readily. Three to ten grammes a day, taken for several days, causes a general poisoning or amaurosis in man, and a much smaller quantity has a similar effect on dogs.

In opposition to Walter, who believes that acute hemeralopia is dependent upon a miasma, DE HAAS (126) believes that in every case there has been a blinding of the eyes by strong light. The disease occurs only in individuals who work in the open air. Direct sunlight is the cause and the cases are cured without other treatment if the eyes are protected from the light. The xerosis of the conjunctiva that often accompanies hemeralopia he considers the first symptom of the burning and drying of the conjunctiva from the action of the sun and the wind. WESTHOFF.

It is now commonly recognized that symptoms of fatigue appear in the course of perimetric tests, both in the healthy and the

diseased eye, but their explanation is still in doubt. Schiele locates the fatigue in the cortex of the occipital lobe, Wilbrand in the retina, and others in the consciousness. SIMON (127) has now made a number of experiments and has found, among other results, that the symptoms of fatigue do not come on when large test objects are used, and when the test objects are carried along with a twitching motion.

BOUVIN'S (128) patient complained of having had blurred vision for two hours, V = $\frac{3}{60}$ E. In the retina was a white exudation, and in two arteries the blood column was interrupted. The eye was massaged twice and the following day V = $\frac{6}{24}$, and the exudation had almost disappeared. The massage was continued and the visual acuteness became normal, with a small defect in the field inwardly. WESTHOFF.

WAGENMANN (129) describes one of the rare cases of tabic atrophy that begin with a central scotoma. Later a defect appeared upward and inward, and at the same time a group of medullated nerve fibres occupying the corresponding position in the fundus lost their medulla. In this case, therefore, it must be supposed that the destructive process which can affect the medulla and the axis-cylinder simultaneously, passed into the eye relatively early, the atrophy therefore not being a descending one.

From a study of these thirty-eight cases, BULL (130) concludes that there has been no better means of dealing with detached retina than the old methods of rest in bed, atropine, a bandage, and the internal administration of some drug that may induce absorption of the subretinal fluid. For this latter he does not consider pilocarpine the best, but prefers small doses of bicarb. of soda and iodide of potas. Puncture can give only a temporary relief, and severing of bands in the vitreous should be made only when they are non-vascular. The methods of Schoeler he condemns entirely. BURNETT.

WÜRDEMANN (131) examined a boy of eight, whose eye had become blind four days before in consequence of measles. There was stoppage of the central vein, dilatation and tortuosity of the retinal veins, striped retinal hemorrhages, and œdema of the macular region. The arteries were very small. The picture resembled that of neuro-retinitis, but a diagnosis of thrombosis of the central veins was made, and the eye having been enucleated later for secondary glaucoma, microscopic examination confirmed the diagnosis. GREEFF.

In DE SCHWEINITZ'S (132) first case a man received an injury to the head and suffered from very pronounced nervous symptoms referable to a central lesion. He had diplopia in the left eye alone. The true image is vertical, the false image in front of it, and inclined towards the left. No optical defect or opacity in the media; fundus normal. In the second, an alcoholic, with central nerve lesions, astigmatism, old iritis, capsular opacities, and cerebral choroiditis, had vertical diplepia more particularly in the left eye. BURNETT.

HEVL (133) reports and pictures a rupture of the lymph sheath of a retinal vein. The vein was tortuous and projected at places into the vitreous. In close proximity to the ruptured sheath and attached to the optic disc were white plaques evidently of a connective-tissue character, and which the author thinks are related to the lymph as effects to a cause. He considers them as organization of the leucocytes which escaped from the ruptured sheath. BURNETT.

XIX.—OPTIC NERVE.

134. ELSCHNIG. On so-called choked disc. *Wien. klin. Wochenschr.*, 1894, No. 51.

135. BJERRUM. On optic atrophy in syphilitic patients. *Med. Aarsskr.*, Copenhagen, 1894.

136. BURNETT. Tumor of the intervaginal space of the optic-nerve sheath. *Trans. Amer. Ophth. Soc.*, 1894.

ELSCHNIG (134) remarks that in the last decades the mechanical theory of the production of choked disc has gradually given place to the Leber-Deutschmann inflammatory theory. Elschnig believes choked disc to be a form of intraocular neuritis, characterized by increase in the volume, prominence, and area of the disc, caused by micro-organisms and their products.

In order to decide whether an optic-nerve atrophy is primary or secondary, BJERRUM (135) lays down the following rules: 1. Unilateral affection indicates secondary atrophy; in primary both nerves are always affected. 2. Hemianopic defects in the field are excessively rare in primary atrophy. 3. Improvement in function, even transitory, is argument against primary atrophy. SCHIÖTZ.

BURNETT'S (136) case was a boy of seven years whose left eye was noticed to protrude slightly three years before he saw him.

The exophthalmos slowly increased, but vision was lost very early. There was no pain ; nerve white and showed evidences of a past papillitis. Movements of globe limited equally in all directions. Eye enucleated and a mass of material attached to the nerve was taken from the orbit afterwards. An examination of sections of the nerves and of the mass showed the same appearances that are usually found in tumors of the intervaginal space. In some portions it was myxomatous, in others spindle-celled, in others fibrous, in others like endothelioma. He regards these growths not as pathological, or at least not malignant, but more of an embryonal character.

XX.—INJURIES, FOREIGN BODIES (PARASITES).

137. HILLMANNS. On injuries of the eye. *Arch. f. Augenheilk.*, xxx., 1., p. 29.

138. KNABE. A contribution to the statistics and clinical histories of eye injuries. *Inaug. Dissert.*, Halle, 1895.

139. SPECHTENHAUSER. On foreign bodies in the eye. *Wien. klin. Wochenschr.*, 1894, No. 43.

140. WAGENMANN. Report on the extraction of a splinter of glass from the anterior chamber, with remarks on the inflammation caused by foreign bodies. *Graefe's Archiv*, xl., 5, p. 180.

141. FROMAGET. Tetanus following traumatism of the eye and its adnexa. Ocular symptoms of tetanus. *Arch. d'opht.*, xiv., 77, p. 657.

142. KNAPP. Two recent magnet operations, one an ideal success, the other a total failure ; with remarks. *Trans. Amer. Ophth. Soc.*, 1894.

HILLMANNS (137) reports on 175 cases of eye injury seen within a year at the Bonn Clinic. Serpiginous ulcer is treated by Saemisch's method.

KNABE (138) reports on 205 cases of eye injury seen within two years in the Halle Clinic. Fine silk sutures are used in cases of gaping wounds of the cornea or sclera.

One of SPECHTENHAUSER'S (139) cases was the spontaneous extrusion through the sclera of a bit of gun-cap that had been in the eye seven years, and one in which an iron splinter had remained in the fundus twenty-eight years. Only three other cases of spontaneous extrusion of a foreign body through the sclera have been described.

WAGENMANN (140) had under observation for a year a case in which a splinter of glass had entered the anterior chamber without injuring the iris or the lens. In the course of time a corneal opacity appeared, such as Leber produced experimentally in rabbits. This was no doubt due to chemical influences, as the foreign body was immobile and could not have caused trauma, and the course of the affection and inoculations after removal of the foreign body showed that it was aseptic. The opacity cleared up after the removal.

Seven days after the loss of the left eye from injury by a rocket, FROMAGET'S (141) patient lost the mobility of the healthy eye and developed a trismus. The pupil was of normal size, but reacted only to accommodation. Sight and accommodation normal. Mobility of the lids normal. The injured eye was removed, and the following day tetanus developed, from which the patient died five days later. The author collates a number of observations of tetanus after injury of the eyeball, lids, and orbital margin, those of the orbital margin having proved most dangerous in this respect. A more detailed account is given of the cases in which spasm and paralysis of the facial and ocular muscles have occurred. These symptoms, the author thinks, are due to infection, like the post-diphtheritic paralyses. In most cases the pupils were small and unresponsive.

In KNAPP'S (142) first case the bit of steel entered at the outer edge of the cornea. The foreign body was seen in the lower part of the retina, some blood in vitreous, and an air bubble in upper part. V=$\frac{20}{30}$. Primary operation refused, but two days later when the eye showed signs of beginning inflammation he returned and the bit of steel was extracted by a Hirschberg magnet through an incision between the external and inferior recti muscles. There was no escape of vitreous, the wound healed without reaction, and V was $\frac{20}{30}$. In the second case a piece of iron penetrated the eye. Its interior was disorganized. The foreign body was not found with the magnet nor after enucleation. BURNETT.

XXI.—OCULAR AFFECTIONS IN GENERAL DISEASES.

143. SIEGRIST. Contributions to the knowledge of the nature and location of ophthalmic migraine. *Thèse de Lausanne*, 1894. *Annales suisse des sciences medicales*, 1894.

144. PERETTI. Traumatic bitemporal hemianopia with remarks

on hemianopic pupillary reaction. *Festschrift z. Feier d. 50jährigen Jubiläums d. Vereins d. Aerzte Reg. Bez. Düsseldorf*, 94.

145. GUILLERY. On latent ocular muscle disturbances in tabes. *Arch. f. Augenheilk.*, xxix., p. 361.

146. HESSBERG. Ocular affections following influenza. *Festschr., Düsseldorf*, 1894.

147. ADAMÜK. Ocular affections after typhoid processes. *Petersb. med. Wochenschr.*, 1894, 38, 39.

148. EDINGER. A new theory of the cause of some nervous diseases, particularly neuritis and tabes. *Volkmann's Sammlung klin. Vorträge*, 94, No. 106.

149. DEGENKOLB. Experiments on the influence of some medicaments on the power of the eye to recognize slight differences in light intensity. *Inaug. Dissert*, Tübingen, 1894.

150. BAAS. On an ophthalmia herpetica. *Graefe's Archiv*, xv., 5, p. 212.

151. WEYMANN. A case of quadrisectorial homonymous hemianopsia. *Amer. Journ. of Oph.*, Oct., 1894.

In SIEGRIST's (143) cases there were vasomotor disturbances, those localized in the dura being capable of causing the migraine and those in the occipital cortex the scintillating scotoma. The vasomotor disturbance is probably a spasm of the vessels of one hemisphere causing an increased excitability. The causes are refractive errors, unusual strain on the eye, or a congenital disposition, and the exciting causes are hunger, fright, weakness of the heart, etc.

PERETTI (144) reports a case of fracture at the base of the skull with bitemporal hemianopsia. At first there was no difference in the pupillary reaction when the two halves of the retina were illuminated separately, but after the left eye had become amaurotic pupillary reaction followed only when the temporal half of the retina was strongly illuminated. From this he concluded that so long as the centre of the retina functionates, the diffusion and reflection of light within the eye affects the pupillary reaction so that the presence or absence of hemianopic pupillary reaction is not a safe diagnostic sign in most cases of hemianopsia.

GUILLERY (145) states that disturbances of the ocular muscles, particularly such as cause transitory diplopia, indicate nervous disease, which is rarely recognized early as the oculist is only con-

sulted when the symptoms are marked. Often there is no spontaneous diplopia and the patient complains of blurred or flickering vision only, and in such cases the diagnosis of muscular disturbance must be made by means of some of the tests for heterophoria.

HESSBERG (146) shows by clinical histories that all parts of the eye may be affected in influenza, but without other characteristic symptoms than are found in the ocular affections with any infectious disease.

EDINGER (147) offers a function theory to explain nervous diseases. Function is a wearing out of the nervous elements, for which in normal conditions metabolism furnishes a restoration. When, however, the function is overstrained or in case injury or disease affects the restoration, the functionating nervous elements are destroyed and the intervening tissue proliferates.

This hypothesis explains not only the disturbances in the eye in tabes, but also the pupillary symptoms, and, according to it, the fibres governing the light reflex must suffer before those governing the accommodation. The levator, abducens, and internus are therefore the earliest and most frequently affected. When the wearing out is not excessive, the affected cell may be restored, and thus the ocular paralysis may disappear and recur. The argument is ingenious, but purely hypothetical.

DEGENKOLB'S (149) experiments were carefully carried out with the aid of Hüfner's spectro-photometer, and confirmed Dreser's finding in regard to the action of strychnin. 0.003 injected into the cheek notably increased the power of the author to distinguish differences in luminous intensity. The action of tea and coffee was doubtful, but alcohol always reduced the perception of differences in luminous intensity.

BAAS'S (150) extracts from the literature show that our knowledge of the connection between eye and liver affections is still incomplete, and two cases that he reports are of great interest. Both were cases of cirrhosis of the liver with icterus in young individuals. Soon after the development of the affection hemeralopia was noticed which persisted while the icterus lasted, and then disappeared. All the vessels of the eye showed endarteritis or endophlebitis leading to circulatory disturbances, with emigration of cells which were in part diffusely scattered and in part gathered into groups.

In WEYMANN'S (151) case, a man, who was evidently a syphilitic, had a paralysis of the right side, and other symptoms pointing to a severe central lesion. The peculiarity of the eye trouble was sectorial defects in the visual fields of both eyes. They were homonymous—that is, down and out and up and in in the right, and down and in and up and out in the left, and the points of the angular sectors came together at the points of fixation. The nerve-head seemed pale, but the vision was fairly good ($\frac{20}{40}$). His general condition improved under heavy doses of iodides, but the eye symptoms remained essentially the same.

BURNETT.

Obituary.

Dr. M. LANDESBERG died at Florence, March 4, 1895. He practised in New York for a number of years, and published many valuable papers, among which we mention: On Keratitis Bullosa, these ARCHIVES, vol. vi., p. 135–169; On the Pathology of the Sympathetic Nerve, *Ibid.*, vol. vii., p. 408, 1878; The Use of Eserine in Glaucoma, *Ibid.*, vol. viii., p. 264; Sarcoma of Choroid in Children, *Ibid.*, vol. viii., p. 345.

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Contents of the last numbers of the Archiv für Augenheilkunde (German edition of these ARCHIVES).

Vol. XXX., No. 4. Issued in May, 1895.

A.—ORIGINAL PAPERS.

XXIII. O. WALTER. Report and Experiences of an Itinerant Cataract Operator in the Latter Part of the Nineteenth Century.

XXIV. RUDOLF DENIG. Anatomical Description of Spontaneous Connective-Tissue Formation in the Vitreous (so-called retinitis proliferans).

XXV. ALEXANDER TEPLJASCHIN. On the Pathological Anatomy of the Intrauterine Inflammations of the Eye and Particularly the Congenital Opacities of the Cornea (two plates).

B.—REPORT ON THE PROGRESS OF OPHTHALMOLOGY IN THE FOURTH QUARTER OF THE YEAR 1894. (Translated in this number.)

C.—MISCELLANEOUS.

Vol. XXXI., No. 1. Issued in June, 1895.

A.—ORIGINAL PAPERS.

I. MOCHEK. Herpes Zoster of the Iris in the Course of Herpes Zoster Fontalis.

II. GIACOMO ROMBOLOTTI. Clinical and Anatomical Contribution to the Simple or Serous Cysts of the Conjunctiva (one plate).

III. O. STUELP. A Case of Traumatic Pulsating Exophthalmus with Autopsy, with one illustration in the text.

IV. P. V. RICHTER. On Intermittent Exophthalmus.

V. RICHARD HILBERT. On So-Called Double Sensations.

VI. E. ASMUS. On the Accurate Localization of Large Iron and Steel Foreign Bodies in the Eye by Means of the Sideroscope.

VII. C. MELLINGER and D. BOSSALINO. Experimental Study on the Diffusion of Fluids Injected Subconjunctivally.

VIII. SEGGEL. A Further Case of Unilateral Reflex Iridoplegia.

IX. AXENFELD. A Further Observation of Corneal Curvature Opposite to that of Keratoconus (corrigible peripheric myopia and corrigible central hyperopia in the same eye). With six illustrations in the text.

X. Original articles from these ARCHIVES, vol. xxiii., Nos. 3 and 4, abstracted by R. Greeff.

Index of titles of articles mentioned in the report of progress for 1894 by authors' names.

New Medical Books.

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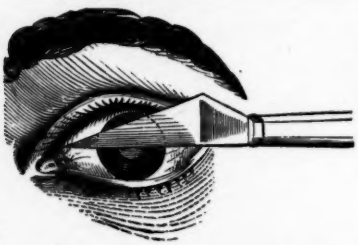

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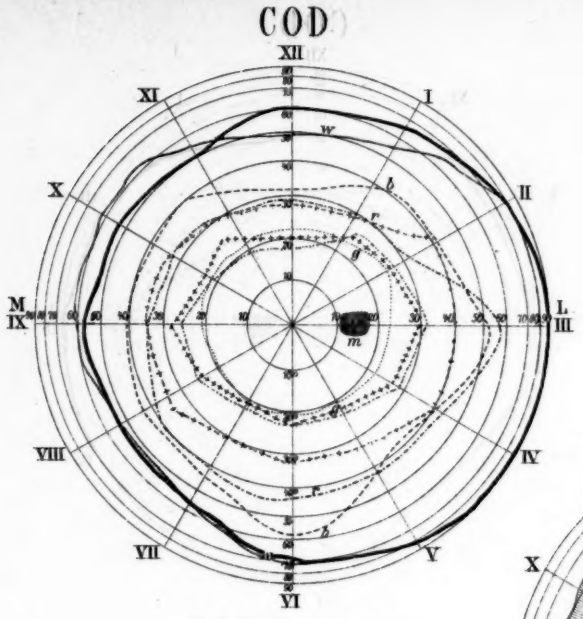

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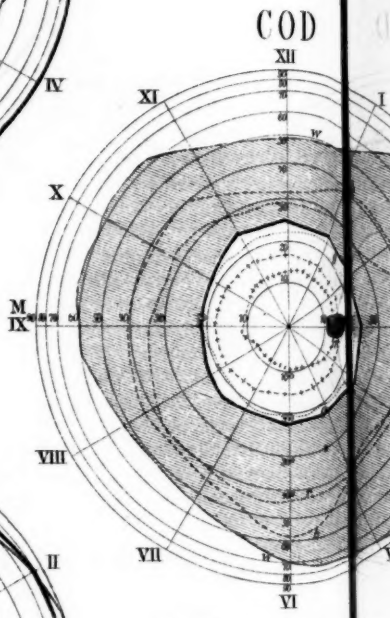

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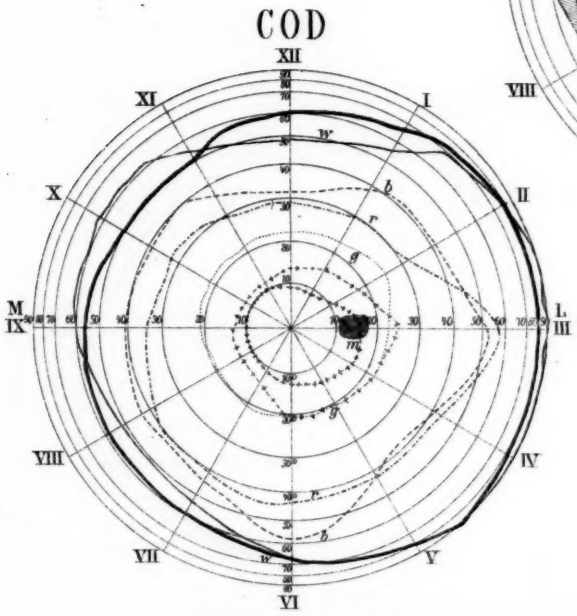

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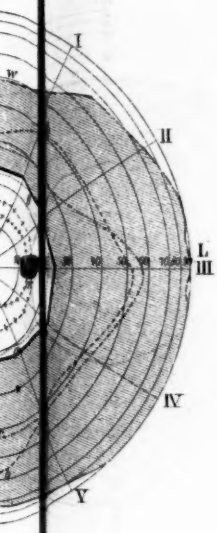

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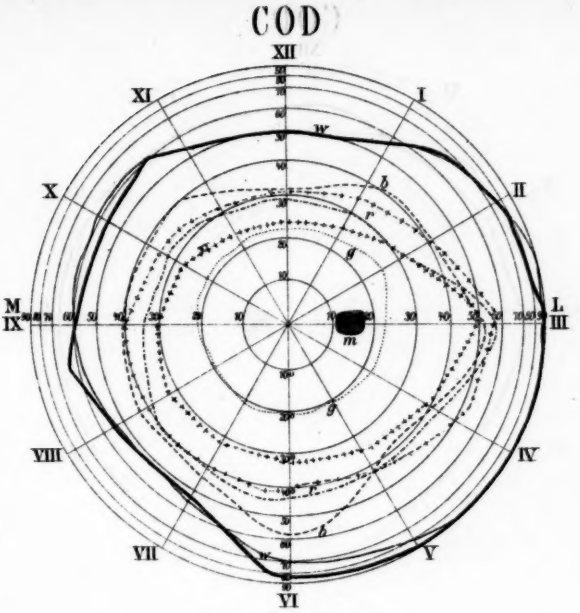

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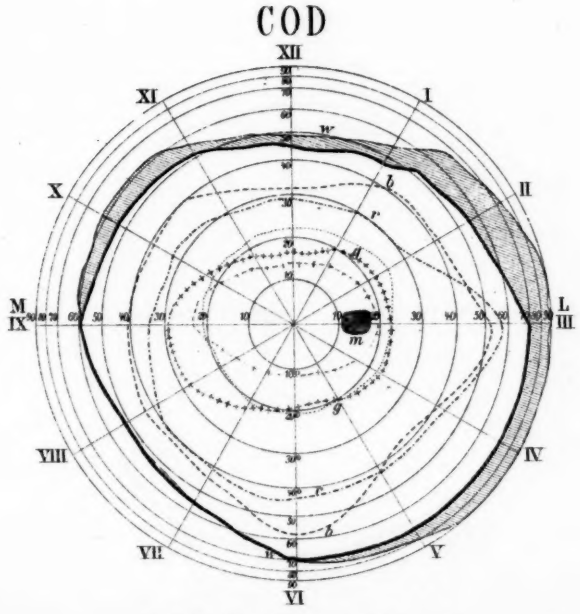

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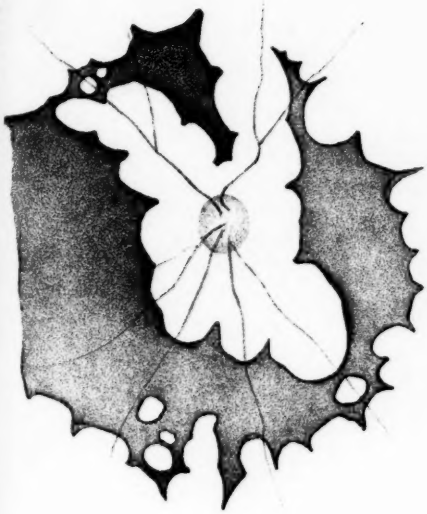

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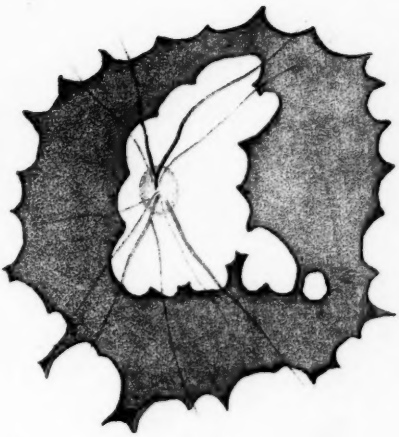

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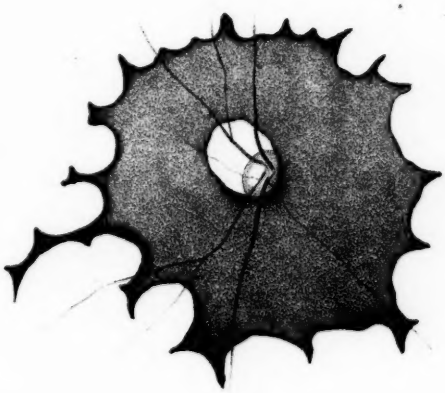

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CONTENTS OF VOLUME XXIV., NUMBER 4.

		PAGE
1.	Observations on Cases of Hemichromatopsia, Indicating the Non-existence of a Separate Cortical Color Centre. By Dr. Ward A. Holden	447
2.	On Choroidal Tumors. By Dr. Mitvalsky, Prague, Austria. Translated and abridged by Dr. Ward A. Holden. (With seven figures on Plates XVIII. and XIX. of Vol. XXVIII. German Edition)	450
3.	Contributions to the Knowledge of the Histological Alterations in the Retina after Experimental Injuries. By Dr. A. Tepljaschin, of Kasan, Russia. Translated (abridged) by Dr. Ward A. Holden. (With figs. 1–28, Plate XXI., XXII., and XXIII., Vol. XXVIII., German Edition)	455
4.	The Palpebral Form of Spring-Catarrh. By Dr. H. Gradle, Chicago	466
5.	A Case of Diphtheritic Conjunctivitis Presenting Unusual Complications Treated by Antitoxin. By Dr. J. Guttman, New York	472
6.	A Dermoid Tumor Involving the Cornea, with Remarks. By L. D. Brose, M.D., Ph.D.	479
7.	A Case of Successful Extraction of a Piece of Steel from an Iris in which a Plastic Inflammation had been Established, with Prompt Subsidence of the Inflammatory Reaction and Restoration of Full Vision. By Edward B. Heckel, A.M., M.D.	482
8.	Report and Experiences of an Itinerant Cataract Operator at the End of the Nineteenth Century. By Dr. O. Walter, Odessa, Russia. Abridged and translated by H. Knapp	484
9.	Light—the Ointment of the Yellow Oxide of Mercury—and the Ointment-Pots in Common Use. By S. Holth, of Drammen, Norway. Translated by Charles H. May, M.D., New York	486
10.	Diplopia in the Periphery of the Field of Fixation and its Bearing on the Diagnosis of Muscular Paralysis. By Dr. A. Duane	491
11.	Report of the Transactions of the Twenty-fourth Ophthalmological Congress, Held in Heidelberg, Aug. 4 to 7, 1895. By Prof. Horstmann and Dr. Greeff, Berlin. Translated by Dr. C. Zimmermann, Milwaukee, Wis.	498

PAGE

12. Systematic Report on the Progress of Ophthalmology in the First Quarter of the Year 1895. By Dr. St. Bernheimer, in Vienna; Prof. C. Horstmann, in Berlin; and Dr. P. Silex, in Berlin; with the assistance of Dr. S. M. Burnett, Washington; Dr. Dantone, Rome; Dr. Herrnheiser, Prague; Prof. Hirschmann, Charkow; Dr. P. von Mittelstädt, Metz; Dr. Sulzer, Geneva; Dr. Werner, Dublin; Dr. C. H. A. Westhoff, Amsterdam; Dr. Schiötz and Dr. Ole Bull, Christiania; Dr. R. Greeff, Berlin; Dr. Deus, Berlin; and others. Translated by Dr. Ward A. Holden 513

A.—Dr. St. Bernheimer. General ophthalmological literature, 513; General pathology, diagnosis, and therapeutics, 516; Instruments and remedies, 516; Anatomy, 518; Physiology, 519.

B.—Dr. C. Horstmann. Anomalies of refraction and accommodation, 521; Lids, 522; Lachrymal apparatus, 524; Muscles and nerves, 524; Orbit and neighboring cavities, 526; Conjunctiva, cornea, sclera, anterior chamber, 528.

C.—Dr. P. Silex. Iris, 531; Choroid, 532; Glaucoma, 532; Sympathetic ophthalmia, 533; Lens, 533; Retina and functional disturbances, 537; Optic nerve, 542; Injuries, foreign bodies, parasites, 543; Ocular disturbances in general affections, 545.

13. Book Reviews 549

Perimetry. By Dr. Ole Bull.
Vorlesungen über den Gebrauch des Augenspiegels (Manual of Ophthalmoscopy). By Prof. C. Schweigger and R. Greeff.

14. Obituary 555

I.—Henry Willard Williams, A.M., M.D.
II.—Dr. Albrecht Nagle.
III.—Dr. Vialet.
IV.—Dr. T. Inouye.

15. Appointments and Honors 557

16. Contents of the Last Number of the *Arch. f. Aug.* (German Edition of these Archives), Vol. xxxi., No. 2 557

17. Index 559